TECHNOLOGICAL POSSIBILITIES OF AGRICULTURAL DEVELOPMENT IN INDIA

A Note

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PREFACE

This note is written as a result of instructions received at the first meeting of the official Committee No. 5 (Agriculture, Forestry and Fisheries) of the Reconstruction Committee of Council, held on the 20th May, 1943, which read as follows :

'(*d*) It was agreed, therefore, that an important preliminary task was to prepare a comprehensive memorandum on the economic and the technological considerations involved. Sir Theodore Gregory undertook to prepare a note on 'the Economic Background of Post-War Agricultural Policy' and Dr. Burns on the 'Technological Possibilities of Agricultural Development (*i*) under conditions more or less as they exist today and (*ii*) under certain *stated* conditions, e.g. decrease in the inefficient cattle population, adoption of scientific methods of cultivation, improved tenancy organization, etc.' The former note will be ready about the end of August and the latter about the end of September and the two together would form the basis of an 'All-India Policy for Post-War Agriculture.'

Mr. H. R. Stewart, C.I.E., Agricultural Commissioner with the Government of India, undertook the organization of the work for the first chapter. Sardar Partap Singh, Assistant Marketing Officer, Central Agricultural Marketing Department, who had previously done work of this kind under Mr. H. R. Stewart, was kindly lent by the Agricultural Marketing Adviser to assist in preparing the tables and graphs for Chapter I and thereafter was allowed to continue to assist me with the rest of the note. His help has been invaluable. Mr. F. Ware, C.I.E., Animal Husbandry Commissioner with the Government of India, drew up the section dealing with livestock. I have thought it best to leave this section as he wrote it (with a minor alteration affecting the estimate of farmyard manure) rather, than incorporate it in a consolidated report (1) because it really is a self contained statement, and (2) on account of Mr. Ware's being on tour, it was not possible to have the consultations necessary for such an amalgamation. My original intention was to have three chapters, the contents of which are described in the Introduction to the Crops section. As an afterthought, I have added a third section giving some general considerations and recording certain of my own views. The main object of the note is, of course, not to present view but to provide raw materials for discussion by the Reconstruction Committee. I trust the note does provide such a basis. This is the justification for including the data expressed as tables and graphs. It is believed that it will be convenient to have all these facts contained in this one compilation.

I have referred draft sections of this note and also isolated questions to many specialists who have generously given the help and information for which I asked. Among them I may mention :

All Directors of Agriculture of the Provinces and of certain constituent States of the Imperial Council of Agricultural Research.

Rao Bahadur B. Viswanath, C.I.E., Director, Imperial Agricultural Research Institute.

Dr. B. P. Pal, Imperial Economic Botanist.

Dr. H. S. Pruthi, Imperial Entomologist.

Dr. G. W. Padwick, Imperial Mycologist.

Mr. D. N. Mahta, Secretary, Indian Central Cotton Committee.

Mr. B. Das, Gupta, Secretary, Indian Central Jute Committee.

Mr. J. S. Quin, Adviser on Rope Supplies.

Rao Bahadur Chaudhary Ramdhan Singh, Cerealist, Punjab Agricultural Department.

Khan Sahib Chaudhri Ali Mohammad, Oilseeds Specialist, Punjab Agricultural Department.

Mr. P. H. Carpenter, C.I.E., Director, Indian Tea Research Station, Tocklai.

Dr. R. D. Rege, Incharge Padegaon Sugarcane Research Station.

Mr. S. C. Roy, Assistant Agricultural Commissioner with the Government of India.

Mr. B. P. Bhargava, Senior Marketing Officer, Central Agricultural Marketing Department, Delhi.

Dr. J. S. Patel, Director, Jute Agricultural Research Laboratories, Dacca.

Dr. B. S. Kadam, Deputy Director of Agriculture (Crop Research) Poona.

Mr. A. B. H. Khoorshid, Economic Botanist, Hyderabad State.

Mr. R. C. Srivastava, O.B.E., Director, Imperial Institute of Sugar Technology, Cawnpore.

Simla — W. BURNS

September 30, 1943

SUMMARY

In his prefaratory remarks, Dr. Burns has said hat the object behind his note is not so much to present views as to provide material for the use of the Reconstruction Committee.

Dr. Burns has prepared his note in four parts.

Chapter I

In the first part, he has endeavoured to show by graphs and statements the progress of farming in India as a whole and also in its various provinces during the last 80 years, in so far as available statistics of acreage and production reveal it. Apart from giving actual figures from year to year, one of the main objects behind these graphs is to indicate what have been the trends and tendencies in India as a whole and in the individual provinces in regard to acreage and production over the last three decades when, with very few exceptions, agriculture was left almost entirely without restriction to shape its own course in regard to the production of individual agricultural commodities. In the case of each graph, he has endeavoured to explain the causes of any violent fluctuations, which have taken place during the period under review and has drawn special attention to the maximum area or production in any year during this period, the minimum acreage and production in any year over the same period and the average area and production.

In considering these graphs and statistics, it should be borne in mind that they cannot be regarded as representing the absolute state of affairs, for agricultural statistics in India are extremely unsatisfactory. Whilst, in the provinces, where settlements are temporary, the figures for area are considered to be fairly accurate, the same standard of accuracy is far from the case in the permanently settled provinces where figures of areas are often largely conjectural. Again, the production calculations are made from standard yields, which are prepared quinquennially, usually on the basis of crop cutting experiments carried out by the different provinces. Experience has proved conclusively that the figures produced by these crop cutting experiments are very unreliable. In the first place, the number of such experiments is infinitesimal in relation to areas grown under the crops, which they represent, and secondly, for various reasons, the results obtained are usually considerably lower than actualities. Yet again, many Indian States do not prepare agricultural statistics at all, and some of those who do, deal only with one or two important crops. For this reason, in the graphs and tables connected with this Section, it has often been impossible to produce all-India figures and, even in those cases where such figures have been given, they are incomplete. For instance, only 66 Indian States prepare statistics at all and they represent only 56 per cent of the area and 67 per cent of the population of all the Indian States. It was, therefore, necessary to confine graphs and tables, mainly to statistics for British India only.

The first 34 graphs deal with all-India areas and productions as well as with the distribution of the land under forests, culturable waste, current fallows, net area sown, irrigated area and area not available for cultivation. Where there is any market trend or tendency in regard to increase or decrease, Dr. Burns has drawn attention to it.

The next 52 graphs provide provincial figures of area and production of each of 13 principal crops in India, including foodgrains, oilseeds, cotton and sugarcane. In each case, the largest production ever secured in any year, the minimum figures in both cases and the average over the whole period under review have been specially mentioned. Explanations have been given, where possible, to account for rises and falls, or any unusual features of the graphs.

Dealing with the [illegible] it may be said that seasons have an overwhelming effect [illegible] marked on crop [illegible] production, [illegible] are also needed [illegible] feature of the [illegible] had very little [illegible]

[illegible] food [illegible] the [illegible] the [illegible] and [illegible]

[illegible] "Grow More [illegible] the [illegible] the [illegible]

[illegible]

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[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

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(i) [illegible]

(ii) [illegible]

(iii) [illegible]

(iv) [illegible]

(v) [illegible]

Dr. Burns [illegible] production were influenced this year and can be [illegible] measures deliberately framed to that end. [illegible] cessation of [illegible] concessions and compulsion [illegible]

He has, I think, not given adequate weight to the effect of season, for a bad monsoon could easily wipe out the effect of all these measures to increase acreage and production, whilst the effect of a good monsoon can far outweigh the results got from any or all of these measures. The monsoon in 1942-43 was particularly favourable and rainfall throughout the year was particularly suitable over a great part of India both for sowing food crops on a large scale and for maturing them.

The influence of season is very clear from some of the figures contained in Dr. Burns' note, where it is seen that, though in several cases the actual sown area of different crops was less than the previous area, the increased production varied from 3 to 32 per cent. Conversely, in some provinces, although there was an increase in sown area, there was a decrease in total production. In Bengal, in particular, whilst the area under rice was only 2 per cent less than the previous year, the production was 28 per cent.

Dr. Burns has not been able to assess the cost at which the "Grow More Food" campaign was carried out, partly because the assistance given was in the form of loans repayable over a considerable period and partly because some of the measures adopted will have a long-term effect.

Chapter III

In this chapter, Dr. Burns takes each of the principal crops in turn, and after considering the average outturn obtained at present, he has tried to assess the technological possibilities of these crops in the future in the light of the yields per acre, which research so far has shown to be possible through such means as using improved varieties of seed, the application of manure and protection from pests and diseases. He gives, in most cases, his opinion as to the extent to which the present average yield of these crops can be raised if all known methods of improvement are put into force.

His conclusions are :

Rice—The average outturn of paddy per acre during the last 5 years was 1,109 lb. (or 738 lb. rice). Dr. Burns considers that, at a conservative estimate, these yields can be increased by 30 per cent, viz., 5 per cent by using improved varieties, 20 per cent by increasing manure, 5 per cent by protecting from pests and diseases. There should even be no difficulty in increasing the present average outturn by 50 per cent, viz., 10 per cent by variety and 40 per cent by manuring.

Thirty per cent of 738 lb. would mean an average outturn of 959 lb. per acre for all India. He concludes by saying that India should aim at an average of 1,000 lb. of rice per acre.

Wheat—For the last 30 years, the average outturn of wheat in India is calculated to be 707 lb. per acre and, during the last 10 years, 640 lb. per acre. Dr. Burns considers that, if only improved varieties are sown, manures applied in the light of results obtained and diseases controlled, it should be possible to aim at an average yield of 1,200 lb. per acre for irrigated wheat and 600 lb. for *barani*. The standard yields in the Punjab are 967 lb. for irrigated wheat and 572 lb. for unirrigated with an all-over yield of 738 lb., whereas, in the United Provinces, they are 1,200, 800 and 786 lb. respectively.

Jowar—Average yields at present obtained are : irrigated 1,200 to 1,500 lb. per acre, *barani* 100 to 700 lb. per acre. Dr. Burns considers that an improvement of 20 per cent is possible.

The all-India average for the last 26 years is 484 lbs. per acre.

Bajra—Dr. Burns places the average all-India yield at about 320 lb. per acre. He considers it possible by adopting dry farming methods, to increase the yield by 25 per cent, i.e. to 400 lb. per acre.

(The average shown in the graphs for the last 12 years is 367 lb. per acre.)

Maize—Dr. Burns thinks that the present average yields of 800 lb. per acre can be increased by 25 per cent to 1,000 lb. per acre.

By adopting the method of "Hybrid Vigour", an increased yield of 35 per cent has been obtained in commercial production in the United States of America.

Gram—Yields very variable, according to whether irrigated or not.

Dr. Burns concludes that, *provided disease-resistant varities are found,* the yield may be raised from an average of 500 lb. per acre to 600 lb. per acre.

According to the graph, the average all-India yield during the last 25 years is only 356 lb. per acre.

Pulses—Little experimental work has been done on these crops so far. Dr. Burns draws no conclusions, except the need for experimentation.

Linseed—So far, there is no improved variety yet in production. No suggestions as regards possibilities are made.

Brassicæ oilseeds—The average yield during the last 31 years was 373 lb. per acre. Dr. Burns concludes that a total improvement of 25 per cent in yield may be achieved (10 per cent by manuring, 15 per cent improved varieties).

Groundnuts—Dr. Burns gives the average yield in India about 900 lb. per acre, but the graph shows that the average for the last 30 years is 1,050 lb. per acre. He thinks it possible to raise the yield to 1,000 lb. per acre and to improve the oil content by 3 per cent.

Castor—The all-India average yield for the last 17 years is 259 lb. per acre. Dr. Burns thinks that, by using improved varieties, the yield can be increased by 10 per cent and the oil-content by 3 per cent.

Sugarcane—Already over 75 per cent of the total area under sugarcane in India is grown under improved varieties, but the average is only about 15 tons of sugarcane per acre. Yields of 30 tons are common and even 50 tons can be obtained. Dr. Burns thinks it possible to produce yields of 30 to 55 tons per acre, according to the part of India.

Cotton—The all-India average yield of lint during the last 30 years is placed at 90 lb. per acre. Dr. Burns while stating that this yield may be increased by improved varieties, manuring, etc., does not lay down any target, as he considers the matter is one of national and international policy. He thinks that the production in 1940-41 may be taken as the maximum production of cotton for peace-time conditions with a constant endeavour to produce more long-staple and less short-staple.

Jute—About 75 per cent of the total area of the Olitorius group are considered to be under improved varieties and 33 per cent of the Capsularis group. Dr. Burns thinks that, by completely growing improved varieties and using manures, the present average of about 16 maunds per acre could be increased to 20 maunds per acre and he thinks that the 9 million bales, got from 3,300,000 acres last year, could be got from 2¼ million acres, thus freeing about three-quarters of a million acres for food crops.

Fibres—Apart from cotton and jute, not much attention has been paid to fibres so far. The main other fibres are sann-hemp, deccan hemp, coir and agaves.

Considerable improvement in the quality of sann-hemp is possible by improving the method of retting.

Dr. Burns does not think that India should attempt to compete in sisal hemp (*Agave Sisalana*) with the African supplies after the war. He thinks the establishment of Fibre Research Station is necessary to study the agricultural, commercial and technological possibilities of fibres.

Tobacco—He thinks that about 100 million lb. of cigarette tobacco were produced in India in 1940-41 on an acreage of 110,000. He contemplates an ultimate area of cigarette tobacco of 200,000 acres and a production of 150 million lb. of flue-cured tobacco.

Fruit—Owing to the absence of any separate statistics of fruit areas or the yields, or any knowledge of the present output, demand, etc., Dr. Burns is unable to fix targets, but he considers that the possibilities are enormous, provided India's fruit products can compete with foreign products and also that the quality of the fresh fruit put on the market is improved.

Vegetables—Owing to the absence of separate statistics, it seems impossible to fix targets.

Potatoes—Here again, statistics are lacking, but, if disease-free seed can be produced, fungal diseases be eliminated and improved methods of storage be adopted, he considers that, on the existing acreage, the production can be doubled.

CHAPTER IV

In the fourth chapter, which he has entitled "The Shape of Things to come," Dr. Burns says that, in agricultural development, two objectives must be held clearly in view. They are: the abolition of the poverty of the cultivator and the abolition of the poverty of the soil. To achieve these objectives, he refers to the need for cutting out various kinds of waste, which exist at present, such as waste of fertilising material, water, soil, etc., and utilising these forces to the maximum capacity.

He refers to the need for strengthening enormously Provincial and State Departments of Agriculture, particularly on their propaganda or extension side. This naturally involves considerable increases in finances. He advocates also the full use of village organizations, individuals, grantees, managers of large estates, etc. He refers to the need for collective action in many matters, such as soil conservation and the control of pests, diseases and wild animals. He proposes that all the various lines of village improvement be linked up with and made part of agricultural development and that one authority should deal with them all.

Dealing with manures, he says that Indian soils are at a stage in which on the whole there is neither increased nor diminished production, and, judging from the results of over 5,000 experiments in India, it is probable in most parts that the soil has become stabilised at a comparatively low level of production. He refers to the different kinds of manure available, many of which, such as compost, both on the farm and from town refuse, are very inadequately utilised, and he concludes his remarks on manure by making a very rough calculation of the quantity of manure, which would be required for each of the main crops, if they were to receive the manurial treatments, which he advocates.

As regards water, he refers to the different available sources, suggests the employment of water diviners for the location of underground supplies, the utilisation of river water by pumping, the use of wind mills for lifting water from wells, the construction of dams on rivers and *nallahs* and the many ways of impounding water in areas near the hills.

On the crop production side, he states that the complete answer to the ravages of insect pests and diseases is the production, where possible, of resistant varieties of crops, but, as that ideal method is not likely to be achieved in all cases, the next important step is the use of fungicides and insecticides. He considers that, for both, there should be a large field for their manufacture in India as well as for the apparatus, required for their application.

Dr. Burns concludes his Memorandum with some remarks on mechanisation. The use of power machinery in India is economical for certain special operations, such as the original clearing of land under jungle, the eradication of deep rooted weeds, anti-erosion work and for cultivation on large estates, particularly sugarcane.

Bullock-drawn implements must, however, continue to constitute the main weapon of cultivation in this country and he refers to the need for experimental work on some of these implements. He finishes by saying that, in any planning of agriculture for the future, one inevitably turns to the great Soviet experiment, and, whilst keeping an open mind in regard to that experiment, he quotes the remarks of Sir Daniel Hall, a well-known British Agriculture Scientist, who stated that the planning of the Soviet organisation was done by men of wide material knowledge of the world and a wide experience of agriculture. They deliberately abandoned the peasant structure of agriculture, to which they had been accustomed and have attempted to use all the resources of science and machinery to replace that peasant system by large-scale exploitation of the land, in order to obtain greater production and more food and to liberate labour for other industries by which the total wealth of the population would be increased.

Section I : CROPS

INTRODUCTION

This section is divided into three chapters. Chapter I attempts to answer the questions : (*a*) What has been the actual production of crops over the years 1911-12 to 1942-43 ? (*b*) What trends or tendencies does such production indicate and what have been the causes of these ? This chapter automatically gives the answer to the first term of reference under which this note is written, i.e. 'technological possibilities of agricultural development (1) under conditions more or less as they exist today.'

Chapter II deals with the Grow-More-Food campaign, regarded as a large-scale experiment indicating what can be done by various measures to increase crop production. The subsidiary questions which it attempts to answer are the following: (*a*) What were the main methods used in the different provinces and states in the Grow-More-Food campaign ? (*b*) What were the results ? (*c*) At what cost were these obtained (taking into account both the central and provincial expenditure) ? (*d*) What conclusions can be drawn from this ? (*e*) What conclusions can be drawn from other large-scale experiments in either reducing or boosting production, e.g. jute restriction in Bengal, effect of the 1932 tariff on sugarcane production, etc.

In Chapter III an attempt is made to answer the second term of reference of this note, i.e. what are 'the technological possibilities of agricultural development (*ii*) under certain stated conditions'. The estimates given in this chapter are on the basis of experimental and other data and are well within the bounds of possibility.

Chapter I—PAST AND PRESENT PRODUCTION

Ninety-seven graphs are presented. Of these, graphs 1 to 34 deal with all-India area and yield, graphs 35 to 86 deal with particular crops in the provinces where they are most important. Graphs 87 to 95 compare the production of major foodgrains for each province with the population of the province throughout the years under review (mostly 1911-12 to 1942-43). Graph No. 96 showing acreage and production of cotton in India was received from the Secretary, Indian Central Cotton Committee. The tables on which these graphs are based are given as appendices. An additional graph (No. 97) illustrates the relation of jute acreage to jute prices.

The figures for the tables for graphs 1 to 95 have been obtained in the following manner.

Acreage

(1) Acreage of the various crops up to 1937-38 has been taken from *Agricultural Statistics of India* and from 1938-39 to 1940-41 from *British India Agricultural Statistics (Provisional)*, except in the following cases: (*a*) Acreage under rice in Assam. (*b*) Acreage under linseed and rapeseed in the United Provinces. (*c*) Acreage under groundnut in Madras during 1912-13 and 1913-14 and in the Punjab from 1933-34 to 1936-37.

Regarding (a)—Acreage under rice in Assam. The acreage given in *Agricultural Statistics of India* includes area under rice seedlings up to 1936-37. As this has to be excluded, the figures have been taken from the *Season and Crop Reports* of the province and *Estimates of Area and Yield*. From 1937-38 onward, however, figures have been taken from *Agricultural Statistics of India*.

Regarding (b)—Acreage under linseed and rapeseed in the United Provinces. The acreage published in *Agricultural Statistics* relates to pure crops only. *Estimate of Area and Yield* gives area under pure as well as mixed crops. The figures have therefore, been taken from the latter.

Regarding (c)—(i) Acreage under groundnut in Madras during 1912-13 and 1913-14. In *Agricultural Statistics*, separate figures for groundnuts are shown in 1914-15, while for previous years groundnuts is included in 'Other Oilseeds'. These two figures have therefore been taken from *Estimates of Area and Yield*. *(ii) Acreage under groundnut in the Punjab from 1933-34 to 1936-37. Agricultural Statistics of India* did not publish acreage for the Punjab for years earlier than 1937-38. The figures from 1933-34 to 1936-37 have been taken from the *Report on the Marketing of Groundnuts in India.*

(2) *Almora, Garhwal and Naini Tal districts of the United Provinces.* There is no agency for the collection of statistics in Almora, Garhwal, and the hill tracts of Naini Tal. Estimates for Garhwal were, however, included in *Agricultural Statistics in India* throughout the period, while those for Almora and the hill tracts were included from 1930-31. In the latter case, estimates have been added for the earlier years to make the data complete and comparable.

(3) *Forecasts.*—For the ten crops (rice, wheat, sugarcane, cotton, jute, linseed, rape and mustard, sesamum, castor-seed and groundnut) for which forecasts are issued, acreages for 1941-42 and 1942-43 have been taken from the respective final and supplementary forecasts.

Production

(1) Figures of production have mainly been taken from *Estimates of Area and Yield of Principal Crops in India* up to 1940-41. For subsequent years figures for the crops for which forecasts are issued have been taken from the respective final and supplementary forecasts.

Whenever the figures of area given in *Estimates of Area and Yield* did not agree substantially with those given in *Agricultural Statistics of India*, production was adjusted according to the area given in the latter.

Whenever the production of a commodity in a province was given along with the states within its boundaries, the share of the province was either found out from its *Season and Crop Report* if given there, or else was worked out in proportion to the acreage.

Production of groundnut in the Punjab from 1933-34 to 1939-40 and in the United Provinces from 1933-34 to 1937-38 was taken from the *Report on the Marketing of Groundnuts in India* as these were available neither from *Estimates of Area and Yield* nor from the *Season and Crop Reports* of the respective provinces. Forecasts are now issued for both the provinces.

Study of Graphs and Tables

We may now study these graphs and tables individually. The figures are unless otherwise stated, *for British India only* (but see page 34). These graphs and tables are important not only as showing actual production, seasonal effects, and trends, but also as data for the discussions following.

In every case years of maximum and minimum production, years of maximum and minimum acreage and the averages (production and acreage) for the whole series of years are indicated. Thereafter comments have been made on any trends or tendencies and their causes.

A. CEREALS

1. Rice

		Million tons			Million acres
1917-18	..	30·9	1942-43	..	70·4
1918-19	..	20·8	1927-28	..	64·8
Average (1911-12 to 1942-43)		25·4			68·0

There has been no consistent expansion or contraction of acreage or production. The fluctuations in acreage have been minor. The acreage in British India ranged between 64·8 million acres in 1927-28 and 70·4 million acres in 1942-43 (1916-17 being a close second with 70·8 million acres). Thus the range of variation has been about 10 per cent on the lowest acreage. Production, on the other hand, has moved within much wider limits. The lowest production was recorded in 1918-19 at 20·8 million tons and the highest in 1917-18 at 30·9 million tons. The range of variation was thus about 52 per cent.

As compared with the five-year period 1911-12 to 1915-16, the area increased by about 2½ million acres during the five-year period 1938-39 to 1942-43, representing a rise of nearly 4 per cent.

The fluctuations in production have been generally due to the amount and distribution of rainfall, floods, and attack of insects pests and diseases like 'blast' and *Helminthosporium*.

In 1917-18 the season was on the whole favourable, especially for the winter crop except in parts of Bombay and Sind and a record crop was obtained.

In the following year 1918-19 the lowest production was recorded though the area did not fall by more than 3 million acres. This was mainly due to the scarcity of rains, especially in Bihar and Orissa, Madras, and the United Provinces. This was also the year of the influenza epidemic.

In 1920-21 the yield was seriously affected by prolonged drought in some areas.

In 1923-24 the outturn was adversely affected in Bengal, Bihar and Madras. In the first-named two provinces the crops suffered due to inadequate rainfall. In Madras, in certain portions it was adversely affected by excessive rainfall; in others due to drought; while in others due to outbreak of 'paddy blast' and the attack of stem-borer.

In 1936-37 timely rainfall helped the crop; particularly in Bengal and Bihar.

In 1940-41, due to insufficient and untimely rains in certain important tracts like Bengal, the yield was poor.

In 1942-43, production fell particularly in Bengal, Madras and Orissa, although this was the year of maximum acreage. This is attributable chiefly to unfavourable weather conditions, damage caused by cyclone in Bengal and Orissa in the late autumn and the attack of *Helminthosporium*.

2. Wheat

		Million tons			Million acres
1929-30 .. 1942-43 ..		9·0	1933-34	..	27·5
1920-21	..	5·7	1918-19	..	19·2
Average (1911-12 to 1942-43)		7·8			24·7

After comparatively violent fluctuations from 1911-12 to 1921-22, production became steady. It gradually declined up to 1927-28 after which a slight upward trend is noticed.

The sudden fluctuations in production have mostly been due to the amount and distribution of rainfall, and to the effect of frost, hail, rust, smut, hot winds at the time of maturity and in certain cases due to prices and to epidemics like influenza.

In 1913-14 production reached a low level of 7·1 million tons. The fall was due to inadequate rainfall at sowing time in the important wheat-growing provinces of the Punjab and the United Provinces.

In 1914-15 production showed an increase of nearly 1½ million tons over the preceding year owing to favourable season at sowing time and attractive prices.

In 1918-19 a very low production was recorded due to drought and the influenza epidemic during the sowing season. The yield further suffered due to insufficient winter rains for maturing the crop in certain areas.

In 1920-21 there was a heavy contraction in the acreage and the lowest production for the period under review was recorded. The acreage declined due to insufficiency of moisture in the soil at sowing time, and the production was further reduced by failure of winter rains and the prevalence of hot winds at ripening.

In 1927-28 the production in the Punjab suffered due to rust, smut, strong dry winds and dust-storms in March and severe local damage from hailstorms. In the United Provinces excessive rain, accompanied in many cases by high winds and hail, damaged the crop.

In 1929-30 the winter rains proved beneficial to wheat, and a record crop was harvested.

In 1933-34 the acreage went up by about 2½ million acres as compared with the preceding year due to favourable conditions at sowing time. The yield on the other hand showed a heavy decline. This was mainly due to high desiccating winds during the ripening period and also due to frost, hail and rust.

In 1938-39 production suffered due to insufficiency of rain water both at the time of sowing and during winter.

3. *Barley*

	Million tons		*Million acres*
1916-17 ..	3·4	1917-18 ..	8·5
1917-18 ..	3·4		
1938-39 ..	1·9	1939-40 ..	6·1
Average (1915-16 to 1941-42)	2·6	..	6·9

Production of barley exhibits a steady downward trend probably due to its substitution by wheat on account of expansion in irrigation.

The record crops harvested in 1916-17 and 1917-18 were mainly due to favourable weather for barley in the main producing provinces. In the United Provinces during 1916-17 the monsoon was prolonged. 'When the rain ceased in October there was very little time for preparing a seed bed ; and the cultivators often preferred to put down barley in place of wheat rather than sow the latter,

on the hastily prepared ground.'* Another possible reason for the expansion of the area under barley is to be found in the rise of its price.

In 1918-19 the acreage declined by about 2 million on account of unfavourable weather at sowing time and the production was further adversely affected by lack of rains in winter.

In 1920-21 there was a heavy fall in acreage and production due to inadequate rains during the sowing season.

In 1927-28 production declined, particularly in the United Provinces due to unfavourable weather as in the case of wheat.

In 1928-29 the acreage crossed the 7½ million acres level after nine years and the production also increased. In the Punjab area expanded due to the presence of moisture in the soil. In the United Provinces, however, the season was generally unfavourable for sowing *rabi* crops and the coarse crop of barley was therefore sown in place of wheat.

In 1938-39 the fall in production was generally due to deficiency of timely rainfall as stated in the case of wheat.

4. Jowar

	Million tons		*Million acres*
1915-16 ..	6·0	1936-37 ..	23·5
1918-19 ..	3·4	1925-26† ..	19·9
Average (1915-16 to 1941-42)	4·6	..	21·3

This graph shows big fluctuations, particularly between 1917-18 and 1921-22. During the subsequent period production has been moving between four and five million tons and does not exhibit any marked trend.

The maximum production in 1915-16 is attributed mainly to the favourable character of the season in the main *jowar* producing provinces.

In 1918-19 production reached a low level of 3·4 million tons due to contraction of area on account of unfavourable weather at the time of sowing. The decline was particularly marked in Bombay where rainfall was poor and the year was considered to be the most disastrous on record. This was also the influenza year.

In 1920-21 production declined by about 2 million tons as compared with the preceding year. This was mainly due to insufficient rainfall and the unfavourable character of the season. The fall was particularly marked in Bombay.

In 1921-22 the acreage reached the peak of 23¾ million acres and production increased by 2 million tons as compared with the preceding year mainly due to ample moisture in the soil at the time of sowing, scarcity of fodder and dearness of foodgrains. In Madras it replaced *korra* and cotton on account of heavy rainfall in October which was too late for these two crops.

In 1925-26 acreage and production fell due to poor rains in Bombay and excessive rains in the Central Provinces and the Punjab. In Madras the crop was partly replaced by groundnut and cotton.

In 1929-30 the acreage and production increased substantially on account of timely rainfall in the main *jowar*-producing areas.

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*From Season and Crop Report of the United Provinces.

†Minimum for the period 1915-16 to 1941-42 for which production is available.

In 1936-37 the acreage once again touched the highest level of 23½ million acres for the period under review. The expansion was particularly marked in Bombay and the Central Provinces due to favourable rainfall, and in the Central Provinces partly due to the rotation of crops. The yield, however, did not rise proportionately. In Bombay the yield was considerably reduced due to poor rainfall during the period of growth, dry winds and the attack of insect pests, while in the Central Provinces, heavy rains towards the end of October and in the second and third weeks of November caused a serious setback.

5. *Bajra*

	Million tons		*Million acres*
1919-20 ..	2·8	1921-22* ..	15·9
1938-39 ..	1·8	1936-37* ..	11·5
Average (1919-20 to 1941-42)	2·2	..	13·4

Here also there are considerable fluctuations but not so great as in *jowar*. A downward trend in production is indicated. It has fallen from about 2·4 million tons during the period 1919-20 to 1923-24 to 2·0 million tons in the five-year period ending 1941-42.

The sudden fluctuations in production are, as in the case of other unirrigated crops, mainly due to the amount and distribution of rainfall at sowing time and during the period of growth and also due to its substitution by other crops, e.g. groundnut, sesamum, *jowar* and in Sind cotton and rice when inundations are favourable.

The record production of 2·8 million tons was obtained in 1919-20 due to favourable weather both for sowing and growth of the crop. In Bombay the cultivators affected by the famine conditions that prevailed in the preceding year were keen to take advantage of the early rains to sow wherever possible crops that would mature early and afford food for human beings as well as fodder for cattle. *Bajri* and *kharif jowar* were accordingly sown with the first fall of rains. In Sind also good rains in the desert portion of Tharparkar and other hilly tracts where *bajri* is extensively grown and favourable inundation elsewhere favoured the cultivation of *bajri* and *jowar*.

In 1920-21 production declined by about ¾ million tons as compared with the preceding year. This was due to contraction in area. In Bombay failure of early rains was responsible. In Madras also rains were untimely in certain parts while in others preference was shown for groundnut, sesamum, *jowar* and *ragi*.

In 1925-26 production declined due to deficiency of rain during the main period of growth and also at the time of sowing in the Punjab.

In 1926-27 both acreage and production increased mainly due to favourable weather conditions for sowing.

In 1928-29 acreage and production declined generally due to deficiency of rainfall for sowing purposes. In Sind this was combined with substitution by other crops, e.g. rice and cotton, to utilize good inundation that occurred during the year.

In 1929-30 production fell mainly in Bombay and Madras on account of contraction in area. In Bombay it was due to very scanty rainfall in the early part of the season.

*Maximum and minimum during the period 1919-20 to 1941-42 for which production data are available.

In 1936-37 both area and production fell appreciably. The fall was particularly marked in Bombay and the United Provinces. In Bombay, the contraction was partly due to rise in the area under *kharif jowar* but chiefly due to insufficient rains at sowing time. In the United Provinces, the rains set in earlier than usual, were heavy and incessant and caused serious hindrance to *kharif* sowings.

In 1938-39, although the acreage was higher than in the preceding two years, the output was lower, probably due to unfavourable weather conditions during the period of growth and maturity of the crop.

6. Maize

	Million tons		*Million acres*
1919-20 ..	2·6	1919-20 ..	6·5
1924-25 ..	1·7	1924-25 ..	5·2
Average (1919-20 to 1941-42)	2·1		5·8

There were considerable fluctuations between 1919-20 and 1925-26. The production declined from 1919-20 to 1924-25, started rising in 1925-26 and continued on the upward trend till 1929-30 after which a slight fall is noticed.

The fluctuations are explained as follows :

In 1919-20 the maximum production was attained due to favourable season, while in 1924-25 the lowest level was touched due to late and inadequate rains in the beginning and excessive rains subsequently. Floods also caused some damage in certain areas.

In 1929-30 both acreage and production rose to fairly high levels chiefly on account of timely rains for sowing.

In 1933-34 production declined on account of excessive rains, floods and attack of insect pests.

In 1936-37 production again fell on account of heavy and incessant rains both at the time of sowing and during the period of growth. Floods also caused some damage.

In 1938-39 excessive rains in certain areas and scanty rains in others led to a fall in acreage and production. In Bihar floods also did some damage.

7. Gram

	Million tons		*Million acres*
1922-23 ..	5·2	1917-18 .. / 1922-23 ..	16·6
1918-19 ..	1·9	1918-19 ..	7·6
Average (1917-18 to 1941-42)	3·5		13·6

There were considerable fluctuations between 1917-18 and 1923-24. In the last six years or so gram blight has reduced the gram area in the North Punjab. The production has fallen from about 4 million tons during the period 1917-18 to 1922-23 (leaving out 1918-19 which was the worst year) to about 3 million tons within the five-year period ending 1941-42.

Substantial fluctuations in production are explained as follows.

In 1918-19 the lowest acreage and production were recorded due to unfavourable weather and to the influenza epidemic during the sowing season.

In 1920-21 both acreage and production dropped heavily owing to the early cessation of the rains as a result of which moisture in the soil was insufficient for sowing. In the United Provinces high temperature and strong westerly winds during the early days of March also adversely affected the crop.

In 1922-23 production increased due to expansion in acreage as a result of ample moisture in the soil at the time of sowing. It was also helped by winter rains.

In 1928-29 production decreased in the United Provinces due to a fall in acreage as a result of deficiency of moisture in the soil at sowing time and, later on, due to frost in February, followed by dry westerly winds in March. In the Punjab, although the area expanded, production decreased on account of severe cold, frost, strong winds and deficiency of rains.

In 1938-39 both acreage and production declined heavily. In the Punjab climatic conditions were unfavourable at the time of sowing and there was a fear of gram blight also. The crop was almost totally destroyed by gram blight in Jhelum and parts of Shahpur district. In the United Provinces also production declined due to insufficiency of winter rains.

8. *Ragi, 'Miscellaneous Food Crops' and 'Other Food Grains including pulses'*

Miscellaneous food crops includes *amaranths*, arrowroot, *kirni*, *mahua*. Miscellaneous food crops in Assam are not included in the total but the acreage is very small.

Other food grains including pulses includes *arhar*, *barbati*, *lobia*, *mung*, horse gram, black gram, field gram, cheick, lentils, *cheena*, *kangni*, *kodo* or *varagu*, *kutki*, *kulhudi*, peas, pigeon or bottle grass, *swank*, chickling vetch, buck wheat, *wudalu* or *barti*, beans and gram in the case of Assam.

Here only the area is recorded.

	Million acres
1914-15	36·6
1918-19	30·3
Average (1913-14 to 1940-41) ..	34·4

After 1918-19 there was a recovery and the area is more or less steady. On the whole, however, the period ended with a fall of about 2 million acres as compared with its beginning. Of this *ragi* alone was responsible for a fall of about 1 million acres.

This concludes the graphs and tables of the foodgrains for all-India.

B. OILSEEDS

9. *Linseed*

	Tons		*Million acres*
1911-12 ..	621,000	1911-12	4·5
1918-19 ..	209,000	1918-19	1·7
Average (1911-12 to 1942-43) ..	391,000	.. .. ..	2·9

There were considerable fluctuations between 1917-18 and 1923-24. At the Crop Planning Conference in 1934, linseed was one of the few crops for which expansion was recommended. In the Ottawa Conference of 1932, it obtained a valuable preference, but the effect of this in India was not marked. Although in the period 1937-38 to 1939-40 the acreage passed the 3 million mark, after

1939-40 there was considerable reduction of acreage, partly as a result of propaganda for the reduction in acreage due to lack of shipping space for export and partly due to the Grow-More-Food campaign.

The main fluctuations in production are explained as follows :

In 1911-12 the maximum production was attained due to a record area being put under the crop to a large extent owing to the timely rains which permitted its cultivation.

In 1913-14 area and production shrank considerably in the important linseed-growing tracts of the Central Provinces and the United Provinces. The crop was seriously affected by drought. Insects, cloudy weather and hail also injured the crop in parts of the Central Provinces.

In 1918-19 the lowest production was recorded. The prolonged drought which prevailed from October to December, not only restricted the area sown but also adversely affected the growth of the crop almost everywhere.

In 1920-21 acreage and production declined due to unfavourable season.

10. Sesamum

		Tons			*Million acres*
1921-22	..	417,000	1914-15	..	4·3
1918-19	..	228,000	1934-35	..	2·7
Average (1911-12 to 1942-43)	..	346,000	..		3·3

There has been a reduction of 30,000 tons in production during the quinquennium ending 1942-43 as compared with the five-year period 1911-12 to 1915-16. No marked trend is, however, noticed in recent years. The important fluctuations in production are explained below :

In 1914-15 a substantial increase in acreage and production took place due to good seasonal conditions.

In 1917-18 contraction in area and production was brought about by lack of sufficient moisture in the soil at the time of sowing. Heavy and continuous rain in September and October adversely affected the crop in almost all provinces.

In 1918-19 acreage and production fell due to the season which, on the whole, was unfavourable, due to drought.

In 1921-22 increased sowings took place due to the presence of ample moisture in the soil. High prices fetched by oilseeds also increased production, and a record crop was harvested.

In 1925-26 continuous rains in the months of June and July retarded sowing as a result of which production declined.

In 1934-35 production again declined heavily on account of the lowest acreage being put under the crop. The shrinkage is generally attributed to unfavourable climatic conditions at sowing time.

11. Rape and Mustard

		Million tons			*Million acres*
1911-12	..	1·3	1917-18	..	7·1
			1911-12	..	7·0
1918-19	..	0·8	1918-19		4·9
1927-28	..				
Average (1911-12 to 1942-43		1·0			6·0

with efforts made towards finding industrial uses for groundnut oil led to a bigger demand for the oil in India. This was attended with an improvement in prices. This again encouraged sowings of groundnuts, and in 1942 about 5 million acres were sown.'

The trend of groundnut acreage, production and prices has also been discussed at pages 3, 4, 11, 84, 90 and 91 of the *Report on the Marketing of Groundnuts in India.*

13. Coconut

Here acreage only is given which has remained more or less stationary between 600,000 and 700,000 acres.

14. Castor

The figures given exclude estimates for the mixed crop in the United Provinces for which there are no reliable data.

	Tons		*Acres*
1925-26 ..	72,000	1925-26 ..	574,000
1935-36 } 1941-42 } ..	42,000	1941-42 ..	380,000
Average (1925-26 to 1942-43)	58,000	.. ..	459,000

The graph for British India shows two definite levels of production, the first ending at the year 1932-33. Hyderabad is the most important state for this crop and the figures given for it by the Director-General of Commercial Intelligence and Statistics in correspondence to Sardar Partap Singh, who prepared the graphs, are as follows:

1938-39	799,988	acres
1939-40	670,993	„
1940-41	780,849	„

These, however, are considerably different from those given in the *Estimates of Area and Yield* which are as follows:

1938-39	550,000	acres
1939-40	387,000	„
1940-41	481,000	„

Area under castor in British India fell by about 100,000 acres in recent years as compared with the period 1920-21 to 1924-25—the earliest period for which separate figures for castor are available. In Madras, the reduction in castor acreage is probably due to the preference for groundnut.

15. Other oilseeds

(Acreage only)

1936-37	1,797,000	acres
1921-22	955,000	„
Average (1920-21 to 1940-41)	1,226,000	„

This includes such seeds as niger seed, safflower seed, sunflower, etc.

The figures show an upward trend since 1935-36, but this is due to the inclusion of safflower seeds which were transferred from the 'Dyeing and Tanning Substances' group to this group during this year.

16. *Condiments and Spices*

This includes such crops as *ajwain*, caraway, chillies, coriander, pepper and also ginger, turmeric and onions:

	Million acres
1934-35	1·7
1913-14	1·2
1914-15	1·2
1920-21	1·2
1929-30	1·2
Average (1911-12 to 1940-41)	1·4

Area under condiments and spices in British India does not exhibit any marked trend.

17. *Sugarcane*

	Million tons		*Million acres*
1936-37 ..	6·1	1940-41	4·4
1913-14 } 1914-15 } ..	2·3	1914-15 } 1921-22 } ..	2·3
Average (1911-12 to 1942-43)	3·5	..	2·9

The following note by the Director, Imperial Institute of Sugar Technology, Cawnpore, is reproduced in full:

'The graph illustrates clearly the fluctuations in the cane acreage as the result *of variations in the grower's return* from the crop. *High cane prices* are usually followed by an increase in the area under cane, which often results in *overproduction* of cane and low sugar and cane prices. These lead to a contraction of the acreage under cane in the following season. The graph thus shows a continuous series of cycles of high and low acreages.

'Till 1932, the year in which tariff protection was granted to the sugar industry, the area under cane remained *very stable*, and varied within the narrow range of 2½ to 3 million acres. With the grant of protection in 1932, the area curve began to rise. This was due to the increased demand of the expanding white sugar industry for sugarcane. In 1934 the Governments of the United Provinces and Bihar began fixing minimum prices for sugarcane purchased by factories. This helped the growers to realize a better return on their crop than they would otherwise, and encouraged them to extend the areas under cane. There is, as a result, a very steep rise in the graph between 1934 and 1936. In 1936-37 the area under cane was about 4½ million acres. The crop was also good and there was a record yield of cane. Factories worked to their full capacity, and there was overproduction of sugar in the country. There was no central organization at that time for the marketing of sugar, and there followed cut-throat competition among factories for the disposal of their stocks. The price of sugar dropped to an uneconomic level, and since the minimum prices of cane were fixed with reference to the prevailing market quotations for sugar, the cultivators received very poor prices for cane. This discouraged sowings for the following season, and the area under cane dropped heavily in 1937-38 and 1938-39.

'The Indian Sugar Syndicate was formed as a voluntary body in 1937. In the subsequent year it was recognized by the Governments of the United Provinces and Bihar which compelled all factories in the United Province and Bihar to become

its members. The Syndicate fixed minimum selling prices for sugar, and regulated sales of members' sugar by the allotment of delivery quotas. It was thus able to arrest the decline in sugar prices. Further, production of sugarcane and sugar were low in seasons 1937-38 and 1938-39, and sugar prices improved steadily. The provincial Governments therefore fixed attractive prices for cane in season 1938-39. As a result the area under cane increased in 1939-40. When this season commenced the markets were starved of sugar and the market quotations (which were only nominal as they did not relate to actual stocks, there being very little sugar in stock in the country at the time) were high. The minimum price for the first fortnight of the season was fixed with reference to these market quotations and was therefore as high as 8 annas 9 pies per maund. The Syndicate now raised its basic and selling prices on the ground that the Government had fixed a very high minimum price for cane. This led to a further rise in the market quotations, and consequently in the minimum price for cane. Thus increase in the market quotations for sugar raised the minimum prices for cane and *vice versa*. This vicious circle continued for the major part of the season. Therefore, although there was overproduction of both sugarcane and sugar in 1939-40, the cultivators received very good prices for cane. This is reflected in a further increase in the area under cane in 1940-41.

'In 1940-41 the provincial Governments of the United Provinces and Bihar decided to restrict the production of sugar in the two provinces by the allocation of crushing quotas to factories. This was necessary in order to liquidate the heavy carryover of sugar in factories. The factories' demand for cane was therefore small and over large areas in the United Provinces and Bihar the growers could not find any profitable outlets for their crop. The minimum price fixed for cane was also very low, being 4 annas 6 pies per maund. The area under cane therefore decreased in 1941-42.

'In season 1941-42 also the United Provinces and Bihar Governments allotted crushing quotas to factories. But owing to crop failure there was acute shortage of cane, and in the East United Provinces and Bihar, factories were unable to obtain supplies of cane to complete their quotas. The production of sugar was therefore low while the demand for sugar had, due to war conditions, increased. Owing to increased purchasing power, the demand for internal civilian consumption also increased. Simultaneously the military demand for sugar increased, and possibilities were opened up for the export of sugar for the use of Allied troops in the Middle and Near East. To make the best possible use of the available stocks, the Government had to institute control over the distribution and prices of sugar. They also exhorted factories and growers to strive for an all-out production in 1942-43. The provincial Governments of the United Provinces and Bihar announced that there would be no control over production in 1942-43. The Governments also required factories to pay on all cane purchased by them in season 1941-42, a deferred price over and above the original purchase price so that the total price might not be less than 7 annas per maund. As a result of these measures the area under cane again increased in 1942-43.'

18. Cotton

	Tons	or *Million bales*		*Million acres*
1941-42 ..	746,000	4·2	1925-26 ..	17·7
1911-12 ..	418,000	2·3	1915-16 ..	11·2
Average (1911-12 to 1942-43)	578,000	3·2	..	11·4

The Secretary, Indian Central Cotton Committee, has kindly prepared another graph showing the all-India acreage and production of cotton during the period 1911-12 to 1942-43 based on the statistics published in the *Estimates of Area and Yield of principal Crops in India* (graph 96). The figures on which this graph is based will also be found in the table containing the figures on which all the graphs have been constructed.

The following note prepared by the Secretary, Indian Central Cotton Committee, fully describes the reasons for the fluctuations in acreage during the period. The effects of the 1930 slump, the declaration of the present war and the Grow-More-Food campaign are indicated by the portions of the graphs lying between (*a*) 1929-30 and 1932-33, (*b*) 1939-40 and 1941-42 and (*c*) 1941-42 and 1942-43.

'The attached graph shows the trend of cotton acreage and production during the period 1911-12 to 1942-43. The portion of the graph between 1913-14 and 1917-18 shows the violent fluctuations in acreage during the period of the first world war. The war in 1914 had at first the effect of depressing cotton prices owing to curtailment of exports and as a result the average price of Broach (forward rate for the nearest delivery period) sagged to Rs. 202 per *khandy* in 1914-15. This was reflected in a sharp decline in the area under cotton in the following year to 17·7 million acres, which was the lowest recorded during the entire period under review. As a result of good prices for cotton in 1915-16 and 1916-17, the cotton acreage rose to 25·3 million acres in 1917-18, showing an increase of 7·6 million acres over the area in 1915-16. The crop, however, suffered owing to unfavourable seasonal conditions. The lower level of exports in 1917-18 and 1918-19, however, was followed by a drop in the cotton area. The cessation of hostilities had the effect of raising the cotton area in 1919-20 when the crop was also good. There was a break in prices in 1920-21 despite the comparatively poor outturn in that year and this was followed by a drop in the cotton area to 18·5 million acres in 1921-22. Thereafter, the acreage continued to increase under the stimulus of steady high prices for cotton until in 1925-26 the area and production reached peak levels at 28·4 million acres and 11·1 lakh tons (6·2 million bales), respec ively. The bumper crop had the effect of depressing cotton prices, which after a short-lived recovery in 1927-28 again took a downward course. The mill industry was also in a depressed condition during 1927-28 and 1928-29 and consumption of Indian cotton in Indian mills was on a lower level. The area under cotton during this period followed generally the course of cotton prices. Owing to the general economic depression all over the world and in line with other commodity prices, cotton prices continued to decline very heavily from the latter half of 1929-30 season. The average price of Broach came down from Rs. 346 per *khandy* in 1928-29 to Rs. 188 in 1930-31. The average price in 1931-32, which recorded a reduced outturn owing to the failure of the Oomras crop, was nearly the same as in the previous year, but compared to American the prices of Indian cotton were high. Owing to a marked falling off in the exports to Japan, the total exports of Indian cotton reached a low level in 1931-32. The result of all these factors was reflected in the reduction of the area under cotton to 22·2 million acres in 1932-33; this was nearly 5 million acres less than the average in the pre-depression year. With the gradual recovery in prices which continued up to 1936-37, the area under cotton tended to increase. The crop in 1936-37 reached the peak figuse of 11·0 lakh tons (6·2 million bales) as a result of favourable seasonal conditions and was almost equal to the previous record reached in 1925-26. Exports during the season which were 4·3 million bales, also reached the highest point and

prices were steady. An alarming situation for Indian cotton developed in 1937-38, owing to a record American crop in that year and the policy of export subsidy adopted by the American Government for disposing of the surplus production. The situation was further accentuated by Japan's inability to import Indian cotton owing to lack of foreign exchange. The war in Spain and exchange difficulties facing Germany and Italy further unnerved prospects of exports of Indian cotton. As a result of these factors, prices of Indian cotton in 1937-38 sagged lower than the levels reached in 1931-32 and continued to be depressed in the succeeding year also. This position reacted on the acreage in 1939-40, which was the lowest reached for several years. The declaration of war in September 1939 had at first a bullish effect on Indian cotton and the acreage increased up to 1941-42, despite the nervous feeling caused by the loss of the continental markets, as the average prices obtained for cotton in the first two years of the war were much higher than the prices which prevailed during 1937-38 and 1938-39. The higher mill consumption of Indian cotton continued to impart steadiness to cotton prices. The position of Indian cotton, particularly of the short-staple types, became very serious early in 1941-42 season when the Far Eastern markets were also closed as a result of the entry of Japan into the war. A special appeal was made by the Indian Cotton Committee to all provincial Governments and States in India, especially in areas where short-staple cotton is grown, to reduce the acreage under such cotton forthwith by at least 50 per cent. The efforts of the Committee in this connection were strengthened by the Grow-More-Food campaign simultaneously undertaken by Government on a country-wide scale. As a result, the area under cotton in 1942-43 declined to 18·8 million acres. The acreage was lower than this figure only twice during the last 30 years.

19. Jute

	Million tons	or *Million bales*		*Million acres*
1912-13 1926-27 1930-31	2·0	11·2	1926-27 ..	3·6
1921-22 ..	0·7	3·9	1922-23 ..	1·4
Average (1911-12 to 1942-43)	1·5	8·4	.. ..	2·7

The acreage figures are really more indicative of trends. In addition to the graphs specially prepared for this note, there is attached a graph (No. 97) prepared by the Secretary, Indian Central Jute Committee, showing all-India acreage (taken from the final forecast figures of the Bengal Department of Agriculture) and prices of loose jute at Narayangunj (Bengal). It will be seen that the sowings of one season are closely correlated with the prices of the previous season. This is also brought out in the following statement:

Season	Prices in previous season	Character of the season		Acreage under jute	Total yield of jute	Remarks
		During sowing	During progress of crop			
1921-22 ..	Low	Favourable ..	Excessive rain and insect pests.	Very low ..	Very low	
1922-23 ..	Do.	Drought and scanty rainfall.	Flood conditions in some parts.	Ditto ..	Ditto	
1926-27 ..	Very high ..	Favourable ..	Favourable on the whole	Very high ..	Very high	
1930-31 ..	Moderate and tending to decline	Drought in some parts ..	Ditto ..	Ditto ..	Ditto	
1931-32 ..	Very low ..	Favourable ..	Ditto ..	Very low ..	Very low	
1932-33 ..	Ditto ..	Drought in some parts ..	Ditto ..	Ditto ..	Low	
1935-36 ..	Ditto ..	Unfavourable. Drought and excessive rain.	Delayed harvesting owing to shortage of rainfall	Ditto ..	Do.	
1940-41 ..	Fairly high ..	Drought in parts ..	General condition satisfactory on the whole	Very high ..	Very high	
1941-42 ..	Low	Excessive rainfall ..	Damage to low lands due to excessive rains	Very low ..	Very low ..	Compulsory restriction of the jute acreage in Bengal to a third of the acreage in 1940-41.

The price of paddy has also an effect on jute. The Secretary, Indian Central Jute Committee, observes:

'It is important to note that during the years under consideration the same price correlation between jute and paddy has been generally maintained. Recently there has been a very serious disturbance in this price correlation, and as paddy is in most cases an alternative crop for jute, this variation in the price correlation between jute and paddy will definitely vitiate the above conclusion, viz. *that the jute acreage in any one year is directly correlated with the* jute prices in the previous season. It holds good only when the price correlation between jute and paddy remains unaltered. If, however, as has happened this year (1943), the price of paddy rules disproportionately high, the cultivators will grow paddy instead of jute even with a rise in price for jute. This is because though jute prices might have doubled, paddy prices have increased about eight times. In the language of the cultivator, formerly one maund of jute would exchange for two maunds of rice, whereas this year one maund of rice is exchanging for 2 or 3 maunds of jute. To be exact, the margin for the cultivation of jute will go down up to that stage at which a cultivator would expect an equal return from the land whether he puts it under jute or paddy, having regard to the suitability of the land for growing jute or paddy, and having regard to the price correlationship between jute and paddy. If, for example, a particular acre of land is expected to yield either 12 maunds of jute or 24 maunds paddy, the cultivator would put jute on that land as long as he expects that the price-relation between jute and paddy would not be less than 2 : 1. If he expects a price relationship which is less than 2 : 1 he would not put jute on it but would put it under paddy. This is a new problem for jute.'

20. *Other fibres (Sann-hemp, Sisal, etc.)*

Acreage only

1914-15	976,000 acres
1918-19	576,000 „
Average (1911-12 to 1940-41)	749,000 „

It is not possible to offer any satisfactory explanations of the fluctuations in the graph. A likely cause of enhanced acreage in 1925-26 might have been that the high price-level reached by jute in 1923-24 affected other commercial fibres.

21. *Indigo*

	Cwts		*Acres*
1917-18 ..	127,000	1916-17 ..	764,000
1939-40 ..	5,000	1937-38, 1939-40 ..	238,000
Average (1911-12 to 1940-41) ..	30,000	.. ..	176,000

It is noticeable that even in this well-nigh extinct crop, there was a rise in 1940-41, apparently due to shortage of other dyes on account of the war.

22. *Coffee*

	Tons		*Acres*
1929-30, 1935-36 ..	12,000	1936-37, 1937-38 ..	98,000
1923-24, 1925-26, 1928-29 ..	6,000	1928-29 ..	87,000
Average (1919-20 to 1939-40) ..	9,000	..	94,000

23. Tea

	Tons		Acres
1940-41 ..	188,000	1937-38 1940-41 ..	739,000
1911-12 ..	113,000	1911-12 } ..	542,000
Average (1911-12 to 1940-41) ..	156,000	..	672,000

The acreage has steadily increased. The five-year period 1911-12 to 1915-16 showed 570,000 acres, while 1936-37 to 1940-41 showed 740,000 acres.

Mr. P. H. Carpenter, Director of the Tocklai Experiment Station of the Indian Tea Association, has prepared the following account of tea production fluctuations :-

'From before 1911, the tea crop of N. E. India was showing a general steady tendency to increase, due to increased demand for Indian tea. The sharp rise in 1915-16 was due to purchase of large stocks of tea by the British Government, and production was maintained at a high level up till 1920. A slump then occurred, due to the unloading on the market of Government stocks accumulated during the 1914—18 war. Prices fell to an unproductive level and efforts were made to raise prices by making higher quality tea through finer plucking. This also had the effect of reducing the quantity. This arrangement was purely voluntary amongst the tea producers themselves. Prices improved during 1922—1926 and crop steadily increased, but the market again became overstocked with a resulting slump. This finally led in 1933 to an international agreement whereby the crop produced was regulated to meet the market demand. India, Ceylon and the Netherlands East Indies were signatories to this agreement.

The permissible quota for each country for each year is expressed as a percentage of the standard export. This figure is decided upon by the International Tea Committee which has its headquarters in London.

The standard export for India was 382,594,779 lb. subsequently revised to 383,242,916 lb. and in 1933-34 the percentage of standard export for India was fixed at 85 per cent of the standard export. This percentage has tended to increase. After the declaration of war and the subsequent stoppage of supplies from the Netherlands East Indies through enemy action, the percentage of the standard export from India rose in 1943 to 125 per cent. Since the introduction of the international agreement, minor fluctuations in the crop have been due almost entirely to climatic conditions which vary from year to year.

The area under tea until 1931 showed a slow but steady increase but since the international agreement, the area has remained nearly constant since new planting is not permitted. This ban on planting has not been lifted.

24. Tobacco

The area has been continually rising. Yields available are from 1928-29.

	Tons		Acres
1934-35 ..	474,000	1939-40 ..	1,181,000
1933-34 ..	391,000	1933-34 ..	976,000
Average (1928-29 to 1940-41) ..	443,000	..	1,075,000

Yields do not by any means follow acreage. The following note by Mr. B. P. Bhargava, Senior Marketing Officer, Central Agricultural Marketing Department, Delhi, comments on the acreage fluctuations and their causes:

'The area under tobacco in British India during the period 1911-12 to 1919-20 fluctuated from year to year within comparatively narrow limits but was followed by a sharp decline in 1920-21. This was mainly due to a smaller area having been sown in Bengal and Madras due to adverse weather conditions. The area recovered next year and thereafter the year to year fluctuations, considering British India alone or the whole of India including Indian states, again remained small and irregular till 1931-32. This was followed by a steady downward trend in 1932-33 and 1933-34 accounted for by a general decrease in the area sown in Madras, Bengal, the Punjab and other areas largely due to low prices obtained and drought in some areas. In 1934-35, there was a noticeable increase in area in Bengal due to the jute restriction campaign, and in Madras, Bombay, the Punjab and the United Provinces, although the area in Bihar declined due to a larger area being sown with sugarcane. In 1935-36 and 1936-37 there was a fall in the area sown in Madras, Bombay, the Punjab and the United Provinces. The crop in Madras suffered from insect attack in 1936-37. From 1937-38 to 1939-40 there was a steady upward trend encouraged mainly by better export demand, especially for Virginia cigarette tobacco from Madras. In 1940-41, there was a small decrease.'

25. *Opium, Cinchona, Indian hemp and other drugs and narcotics*

(Acreage only)

	Acres
1916-17	405,000
1937-38	195,000
Average (1911-12 to 1940-41)	266,000

This decrease is mainly due to the falling off in the acreage under opium.

26. *Fodder crops*

This includes such crops as fodder *jowar*, Guinea grass, lucerne fodder, oats, etc.

(Acreage only)

	Million acres
1936-37	10·6
1915-16	7·0
1918-19	7·0
Average (1915-16 to 1941-42)	9·1

The area has increased from about 7½ million acres during the five-year period 1915-16 to 1919-20 to about 10½ million acres during the quinquennium ending 1940-41, representing a rise of over 40 per cent.

27. *Fruits and vegetables including root crops*

This is an unsatisfactory graph. It lumps together so many things and its accuracy is doubtful. A recent rough estimate indicates that fruit trees cover about 2½ million acres and vegetables about 700,000 acres.

28. *All major foodgrain production compared with population*

It will be seen that there is no general rise in production although there is a slightly rising trend in acreage from 1927-28 to 1940-41.

	Million tons		*Million acres*
1919-20 ..	54·5	1922-23 ..	159·2
1921-22 ..	54·3	1920-21 ..	143·6
1922-23 ..	54·8		
1920-21 ..	41·6		
Average (1919-20 to 1941-42) ..	47·8	..	153·8

The curve of population has been imposed on this in order to show how population is drawing away from the food supply.

The following table also shows the same state of affairs :

Year	*Acreage per person under food crops including all foodgrains, sugarcane, vegetables, fruits, condiments and spices*
1911..	0·88
1921..	0·86
1931..	0·79
1941..	0·67

The figures for 1911, 1921, 1931 are those given by P. K. Wattal in his book, *The Population Problem of India*. The 1941 figure has been calculated from the 1941 census on the basis of the acreage for 1941-42.

29. *Area under forests*

	Million acres	*Square miles*
1940-41	68·3	106,719
1911-12	61·9	96,719
Average (1911-12 to 1940-41)	66·8	103,594

These figures do not tally with those supplied by the Inspector-General of Forests. His figures are :

	Square miles
1911-12	105,607
1914-15	107,501
1939-40	98,721
Average (1911-12 to 1939-40)	103,126

Of the 7,000 square miles decrease between 1911-12 to 1939-40 something over 3,000 square miles can be accounted for by areas handed over in Madras to village forests.

30. *Area not available for cultivation*

(This does not include forests)

	Million acres
1911-12	104·8
1940-41	86·7
Average (1911-12 to 1940-41)	95·8

Showing a steady drop.

31. *Culturable waste other than fallow*

	Million acres
1940-41	97·9
1917-18	86·4
Average (1911-12 to 1940-41)	92·3

There has been a general upward trend

32. *Current fallows*

	Million acres
1918-19	67·5
1916-17	40·6
Average (1911-12 to 1940-41)	46·7

In later years there has been no special trend though a fall appears from 1938-39.

33. *Net area sown*

	Million acres
1916-17	215·1
1933-34	214·0
1918-19	186·5
Average (1911-12 to 1940-41)	208·8

34. *Irrigated area*

	Million acres
1940-41	55·8
1911-12	39·7
Average (1911-12 to 1940-41)	47·5

A continuous and marked increase.

C. GRAPHS OF INDIVIDUAL CROPS IN THE PROVINCES WHERE THEY ARE IMPORTANT

35. *Rice in Assam*

	Million tons		*Million acres*
1911-12 ..	2·0	1936-37	
1915-16		1938-39	
1918-19		1939-40 ..	5·4
1921-22 ..	1·3	1940-41	
1927-28		1929-30 ..	4·1
1929-30			
Average (1911-12 to 1942-43) ..	1·6		4·7

36. Rice in Bengal

	Million tons		Million acres
1936-37 ..	9·8	1940-41 ..	23·8
1941-42 ..	9·8	1927-28 ..	18·7
1928-29 ..	9·7		
1942-43 ..	6·9		
1940-41 ..	6·0		
Average (1911-12 to 1942-43) ..	8·2	..	21·2

Note the drop of 2·9 million tons between 1941-42 and 1942-43. This graph shows violent fluctuations. Acreage and yield are obviously much affected by season.

37. Rice in Bihar and Orissa

	Million tons		Million acres
1911-12 } ..		1911-12 ..	17·4
1916-17 } ..	8·9	1932-33 ..	13·1
1917-18 } ..			
1940-41 ..	8·5		
Average (1911-12 to 1942-43 ..	5·7	..	14·8

There has been a steady decline throughout the whole period. The acreage showed an almost consistent downward trend up to 1932-33. It fell from 16·84 million acres during the period 1911-12 to 1915-16 to 13·94 million acres during the five- year period ending 1932-33, representing a fall of 2·40 million acres. This decrease had taken place almost entirely in the acreage under winter rice, and does not appear to be due to the substitution of rice by other crops. The net area sown, however, decreased by 1·91 million acres during the corresponding period. Mr. D. R. Sethi is of the opinion that the fall may probably be unreal and may be simply due to inaccuracies of figures, which are based on the estimates of village chowkidars, etc., and not on field to field survey as is done in the temporary settled provinces.

Production also followed acreage in its downward trend, but the fall was greater. This disparity in fall is due to the revision of standard yields in later years, as is seen from the figures given below :

	Yield per acre in lb.*				
	1911-12 and 1916-17	1921-22	1926-27	1931-32	1936-37
Winter rice	1,234	987	987	987	823
Summer rice	800	800	800	800	741
Autumn rice	800	741	741	741	658

*Quinquennial Report on the Average Yield per acre of principal crops in India for the period ending 1936-37

38. *Rice in the Central Provinces*

	Million tons		*Million acres*
1942-43 ..	1·9	1939-40 } ..	5·9
1918-19 } ..	0·7	1940-41 }	
1920-21 }		1911-12 ..	4·8
Average (1911-12 to 1942-43) ..	1·5	..	5·4

There has been a general rise in acreage though not in production. In recent years, fluctuations have not been so marked.

39. *Rice in Madras*

	Million tons		*Million acres*
1916-17 ..	6·0	1917-18 }	
1911-12 ..	8·9	1930-31 } ..	11·7
		1933-34 }	
		1935-36 ..	9·8*
Average (1911-12 to 1942-43) ..	4·9	..	10·9

Recently the production appears to have been fairly steady and the graph shows no marked fluctuations.

40. *Rice in the United Provinces*

Million		*Million acres*	
1916-17 }		1938-39 } ..	7·8
1917-18 } ..	2·7	1939-40 }	
1928-29 ..	1·1	1911-12 ..	5·4
Average (1911-12 to 1942-43)	2·0	..	6·9

During the period 1933-34 to 1938-39 production was fairly steady at about 2 million tons.

41. *Wheat in Bihar and Orissa*

	Tons		*Acres*
1916-17 ..	598,000	1918-14 ..	1,342,000
1942-43 ..	582,000	1918-19 ..	980,000
1914-15 ..	357,000		
Average (1911-12 to 1942-43) ..	478,000	..	1,196,000

42. *Wheat in Bombay and Sind*

	Tons		*Million acres*
1917-18 ..	709,000	1933-34 ..	3·2
1920-21 ..	285,000	1918-19 ..	1·1
Average (1911-12 to 1942-43) ..	500,000	..	2·3

*Excluding statics for portions of Ganjam and Vizagapatam districts transferred to the Orissa Provinces.

The trend has been upward presumably due to the effect of the Lloyd Barrage in Sind.

43. *Wheat in the Central Provinces and Berar*

	Tons		*Million acres*
1916-17 ..	1,124,000	1917-18 ..	3·9
1920-21 ..	352,000	1921-22 ..	2·4
Average (1911-12 to 1942-43 ..	721,000	..	3·3

Except for 1942-43 the trend has recently been downwards.

44. *Wheat in the Punjab*

	Million tons		*Million acres*
1942-43 ..	4·2	1942-43 ..	10·4
1920-21 ..	2·0	1918-19 ..	7·7
Average (1911-12 to 1942-43) ..	3·1	..	9·3

Both acreage and production show an upward trend.

45. *Wheat in the United Provinces*

	Million tons		*Million acres*
1929-30 ..	3·4	1933-34 ..	8·6
1913-14 } 1925-26 } ..	2·3	1918-19 ..	5·6
Average (1911-12 to 1942-43) .	2·7	..	7·4

The general trend of acreage is upward but the yield appears to be steady.

46. *Barley in Bihar and Orissa*

	Tons		*Acres*
1921-22 ..	618,000	1932-33 ..	1,526,000
1935-36 ..	368,000	1939-40 ..	1,205,000
Average (1911-12 to 1942-43) ..	494,000	..	1,321,000

Both acreage and production are more or less steady.

47. *Barley in the Punjab*

	Tons		*Acres*
1917-18	421,000	1917-18 ..	1,475,000
1920-21 ..	103,000	1938-39 ..	575,000
Average (1911-12 to 1942-43) ..	253,000	..	917,000

Acreage shows violent fluctuations while production is steadier. Both show a downward trend.

48. Barley in the United Provinces

	Million tons		Million acres
1916-17 ..	2·4	1917-18 ..	5·2*
1938-39 ..		1937-38 ..	
1939-40 ..	1·2	1939-40 ..	3·8
1941-42 ..			
Average (1913-14 to 1942-43) ..	1·6	..	4·3

The trend is downward.

49. Jowar in Bombay and Sind

	Tons		Million acres
1915-16 ..	2,227,000	1936-37 ..	10·3
1911-12 ..	1,044,000	1911-12 ..	6·5
Average (1911-12 to 1942-43) ..	1,612,000	..	8·3

There are considerable fluctuations and a general slight downward trend in recent years.

50. Jowar in the Central Provinces and Berar

	Tons		Million acres
915-16 ..	1,645,000	1942-43 ..	5·4
1920-21 ..	501,000	1917-18 ..	
		1925-26 ..	
Average (1911-12 to 1942-43) ..	1,011,000	..	4·4

There have been big fluctuations from year to year. In the last few years, the area has been steady round about 4·25 million acres.

51. Jowar in Madras

	Tons		Million acres.
1921-22 ..	1,524,000	1913-14 ..	5·8
1912-13 ..	943,000	1933-34 ..	4·4
Average (1912-13 to 1942-43) ..	1,301,000	..	5·0

The fluctuations have been less than in other provinces with a centre about 1,300,000 tons.

52. Jowar in the Punjab

	Tons		Acres
1919-20 ..	200,000	1916-17 ..	1,494,000
1918-19 ..	43,000	1911-12 ..	554,000
Average (1911-12 to 1941-42) ..	105,000	..	969,000

The acreage shows violent fluctuations while the production is steadier. Both show a downward trend.

*Maximum during the period 1913-14 to 1942-43 for which production figures are available.

53. *Jowar in the United Provinces*

	Tons		*Acres*
1915-16 ..	665,000	1921-22 ..	2,684,000
1918-19 ..	198,000	1911-12 ..	1,688,000
Average (1911-12 to 1942-43) ..	482,000	.. ..	2,287,000

This shows big fluctuations from year to year.

54. *Bajra in Bombay and Sind*

	Tons		*Million acres*
1914-15 ..	919,000	1912-13	6·6
1918-19 ..	256,000	1918-19 ..	3·3
Average (1911-12 to 1942-43) ..	640,000	..	5·0

The graph shows big fluctuations.

55. *Bajra in Madras*

	Tons		*Million acres*
1916-17	925,000	1915-16 ..	3·7
1913-14 ..	535,000	1941-42 ..	2·5
Average (1912-13 to 1942-43) ..	737,000	..	3·0

The fluctuations are not so large as in other provinces. Both acreage and production show downward trend in recent years.

56. *Bajra in the Punjab*

	Tons		*Acres*
1942-43 ..	644,000	1942-43 ..	4,135,000
1911-12 ..	97,000	1911-12 ..	1,155,000
Average (1911-12 to 1942-43)	338,000	..	2,856,000

The graph shows marked fluctuations and a slight upward trend.

57. *Bajra in the United Provinces*

	Tons		*Million acres*
1942-43	646,000	1918-19 }	
1913-14	269,000	1941-42 }	3·0
		1942-43 }	
		1925-26 ..	1·6
Average (1911-12 to 1942-43) ..	486,000	..	2·3

The fluctuations are considerable. From 1911-12 to 1925-26 the trend appears to be downwards while in the later period it is upward.

58. *Maize in Bihar and Orissa*

	Tons		Acres
1921-22 ..	727,000	1932-33 ..	1,821,000
1924-25 ..	263,000	1940-41 ..	1,438,000
Average (1911-12 to 1942-43) ..	498,000	..	1,659,000

Fluctuations noticeable.

59. *Maize in the North-West Frontier Province*

	Tons		Acres
1917-18 ..	249,000	1938-39 ..	486,000
1919-20 ..	123,000	1911-12 ..	410,000
Average (1911-12 to 1941-42) ..	207,000	..	450,000

Production has been fairly steady since 1927-28 at about 200,000 tons.

60. *Maize in the Punjab*

	Tons		Acres
1919-20 ..	496,000	1942-43 ..	1,274,000
1914-15 ..	283,000	1924-25 ..	922,000
Average (1911-12 to 1942-43) ..	889,000	.. ..	1,096,000

The graph shows marked fluctuations.

61. *Maize in the United Provinces*

	Tons		Acres
1915-16 ..	1,162,000	1915-16 ..	2,681,000
1918-19 ..	512,000	1924-25 ..	1,564,000
Average (1911-12 to 1942-43) ..	781,000	..	2,089,000

This graph shows violent fluctuations.

62. *Gram in Bihar and Orissa*

	Tons		Acres
1922-23 ..	670,000	1917-18 ..	1,556,000
1918-19 ..	366,000	1911-12 ..	992,000
Average (1911-12 to 1942-43) ..	501,000	..	1,391,000

After 1934-35 there was a general drop with stabilisation at about 450,000 tons. In 1941-42, however, the production exceeded 500,000 tons.

63. *Gram in the Central Provinces and Berar*

	Tons		Acres
1925-26 ..	285,000	1932-33	1,365,000
1920-21 ..	129,000	1920-21 1921-22	899,000
Average (1911-12 to 1942-43) ..	218,000		1,142,000

There are no violent fluctuations in recent years since 1929-30. Production stabilised at about 200,000 tons since 1929-30.

64. *Gram in the Punjab*

	Tons		*Million acres*
1922-23 ..	1,510,000	1933-34 ..	6·6
1920-21 ..	361,000	1918-19 ..	2·0
Average (1911-12 to 1942-43) ..	891,000	.. ..	4·1

The graph shows very violent fluctuations.

65. *Gram in the United Provinces*

	Million tons		*Million acres*
1911-12 } 1922-23 }	2·5	1922-23 ..	7·1
1913-14 ..	0·6	1918-19 ..	2·7
Average (1911-12 to 1942-43) ..	1·7	..	5·6

In recent years there has been stabilisation at about 1·5 million tons.

66. *Linseed in Bihar and Orissa*

	Tons		*Acres*
1917-18 ..	172,000	1922-23 ..	746,000
1940-41 ..	72,000	1940-41 ..	543,000
Average (1911-12 to 1942-43) ..	111,000	..	611,000

There were big fluctuations in the early years and a big drop even after the Ottawa preference. The fluctuations may be due to the difficulty of estimating yield on account of mixed crops.

67. *Linseed in the Central Provinces and Berar*

	Tons		*Acres*
1912-13 ..	142,000	1911-12 ..	1,859,000
1918-19 } 1920-21 }	16,000	1920-21 ..	447,000
Average (1911-12 to 1942-43) ..	82,000	..	1,059,000

This shows considerable fluctuations. There is a rise visible after the Ottawa preference came into effect.

68. *Linseed in the United Provinces*

	Tons		*Acres*
1911-12 ..	300,000	1911-12 ..	1,596,000
1918-19 ..	72,000	1918-19 ..	390,000
Average (1911-12 to 1942-43) ..	159,000	..	915,000

There are considerable fluctuations but no general trend downwards or upwards. Ottawa preference had apparently little effect.

69. *Sesamum in the Central Provinces and Berar*

	Tons		*Acres*
1915-16 ..	91,000	1914-15 ..	926,000
1917-18 ..	24,000	1917-18 ..	408,000
Average (1911-12 to 1942-43) ..	48,000	..	581,000

Considerable fluctuations.

70. *Sesamum in Madras*

	Tons		*Acres*
1919-20 ..	117,000	1911-12 ..	887,000
1912-13 ..	65,000	1934-35 ..	653,000
Average (1911-12 to 1942-43) ..	93,000	..	761,000

Considerable fluctuations.

71. *Sesamum in the United Provinces*

	Tons		*Acres*
1942-43 ..	156,000	1942-43 ..	1,440,000
1918-19 ..	46,000	1925-26 ..	921,000
Average (1911-12 to 1942-43) ..	108,000	..	1,191,000

Considerable fluctuations.

72. *Rape and Mustard in Assam*

	Tons		*Acres*
1925-26 ..	74,000	1938-39 } 1939-40 } ..	406,000
1935-36 ..	45,000	1917-18 ..	264,000
1932-33 ..	43,000		
Average (1911-12 to 1942-43) ..	58,000	..	338,000

This shows fairly large fluctuations with a centre line about 50,000 tons.

73. *Rape and Mustard in Bengal*

	Tons		*Acres*
1913-14 ..	268,000	1912-13 ..	1,325,000
1925-26 ..	84,000	1933-34 ..	693,000
Average (1911-12 to 1942-43) ..	165,000	..	893,000

From 1913-14 till 1925-26, there was a steady drop, then a rise to 1934-35, a drop to 1940-41, and a rise till 1942-43.

74. *Rape and Mustard in Bihar and Orissa*

	Tons		*Acres*
1924-25 ..	213,000	1919-20 ..	827,000
1914-15 ..	99,000	1942-43 ..	500,000
Average (1911-12 to 1942-43) ..	145,000		679,000

From 1924-25 there was a steady drop. The production appears to have partly stabilised at 100,000 tons.

75. *Rape and Mustard in the Punjab*

	Tons		*Acres*
1922-23 ..	241,000	1928-29 ..	1,722,000
1920-21 ..	94,000	1920-21 ..	588,000
Average (1911-12 to 1942-43) ..	158,000	..	1,028,000

The graph shows violent fluctuations.

76. *Rape and Mustard in the United Provinces*

	Tons		*Acres*
1911-12 ..	647,000	1930-31 ..	3,475,000
1927-28 ..	297,000	1918-19 ..	1,944,000
Average (1911-12 to 1942-43) ..	477,000	..	2,677,000

There has been a slight rise recently with a centre of production at 550,000 tons.

77. *Groundnut in Bombay and Sind*

	Tons		*Acres*
1933-34 ..	643,000	1940-41 ..	1,580,000
1918-19 ..	74,000	1918-19 } 1919-20 } ..	186,000
Average (1912-13 to 1942-43) ..	358,000	..	728,000

Both acreage and production show considerable expansion. Acreage and production move close together up to 1923-24 after which they move wide apart.

78. *Groundnut in Madras*

	Tons		*Acres*
1937-38 ..	2,059,000	1937-38 ..	4,658,000
1912-13 ..	341,000	1912-13 ..	924,000
Average (1912-13 to 1942-43) ..	1,157,000	..	2,542,000

Both acreage and production show upward trend. There are violent fluctuations in individual years.

79. *Cotton in Bombay and Sind*

	Tons	*Million bales*		*Million acres*
1936-37 ..	208,000	or 1·1	1925-26 ..	5·5
1918-19 ..	102,000	„ 0·6	1921-22 ..	3·0
Average (1911-12 to 1942-43) ..	164,000	„ 0·9	..	4·5

Both acreage and production show a good deal of fluctuation and a slightly upward trend excepting fall in 1941-42 and 1942-43, due to the Grow-More-Food campaign.

80. Cotton in the Central Provinces and Berar

	Tons		Million bales		Million acres
1928-29 ..	238,000	or	1·3	1925-26 ..	5·4
1931-32 ..	89,000	,,	0·5	1942-43 ..	3·2
Average (1911-12 to 1942-43) ..	158,000	,,	0·9	..	4·4

Since 1928-29 production has dropped and come to a level of about 125,000 tons.

81. Cotton in Madras

	Tons		Million bales		Acres
1918-19 ..	104,000	or	0·6	1918-19	..3,133,000
1914-15 } 1915-16 } ..	43,000	,,	0·2	1921-22	..1,783,000
Average (1911-12 to 1942-43) ..	77,000	,,	0·4		..2,366,000

The graph shows violent fluctuations.

82. Cotton in the Punjab

	Tons		Million bales		Acres
1936-37 ..	260,000	or	1·5	1937-38	..3,136,000
1915-16 ..	30,000	,,	0·2	1916-17	..1,065,000
Average (1911-12 to 1942-43) ..	122,000	,,	0·7		..2,090,000

Both area and production show considerable expansion. During 1942-43, however, there is a fall due to the Grow-More-Food campaign.

83. Sugarcane in Bengal

	Tons		Acres
1936-37 ..	626,000	1936-37 ..	355,000
1924-25 ..	210,000	1928-29 ..	196,000
Average (1911-12 to 1942-43) ..	326,000	..	244,000

Up to 1931-32 production remained fairly steady. Later on it increased considerably.

84. Sugarcane in Bihar and Orissa

	Tons		Acres
1935-36 ..	687,000	1940-41 ..	548,000
1924-25 ..	250,000	1915-16 ..	262,000
Average (1911-12 to 1942-43) ..	376,000	..	335,000

The production was steady at about 300,000 tons up to 1932-33 after which a sudden expansion took place.

85. Sugarcane in the Punjab

		Tons			*Acres*
1940-41	..	470,000	1932-33	..	558,000
1911-12	..	180,000	1911-12	..	298,000
Average (1911-12 to 1942-43)	..	344,000	..		440,000

The graph shows considerable fluctuations in individual years. The tariff seems to have had little effect on production in the Punjab.

86. Sugarcane in the United Provinces

		Million Tons			*Acres*
1936-37	..	3·8	1940-41	..	2,518,000
1913-14 1918-19 1920-21	..	1·0	1921-22	..	1,152,000
Average (1911-12 to 1942-43)	..	1·8	..		1,595,000

Individual years show considerable fluctuations. The production expanded after 1928-29.

Sind

Acreage and production of rice, wheat and cotton in Sind are shown separately in statement No. 97 but no graphs have been prepared for it. These figures show the effect of the Sukkur Barrage which started functioning in 1932-33.

D. GRAPHS COMPARING MAJOR FOODGRAINS WITH POPULATION BY PROVINCES

Graphs 87 to 95

In all provinces it is apparent that the population is increasing more than production. This is most marked in Madras and least so in the Central Provinces. The United Provinces also shows a very noticeable disparity between population and production.

Comments on the graphs as a whole

The following points emerge from the study of these graphs :

(1) Season has an overwhelming effect, on both acreage and production, particularly in the case of :

(*a*) Crops dependent on rainfall.

(*b*) Crops not of the 'cash type. 'Cash' crops are also much affected by the prices of the preceding season.

(2) There is a very large gap between the production in the best and worst years whether we take all-India or individual provinces. It is most marked naturally in individual provinces.

(3) 1918-19 is a year of peculiarly low production. This was largely the effect of the influenza epidemic which affected particularly the *rabi* crop as there was not the labour to sow it. That crop also suffered from drought. As an

example of good and bad years following one another may be mentioned : 1917-18 good followed by 1918-19 bad. Also 1919-20 followed by 1920-21 (wheat in the Punjab, graph No. 44, barley in the Punjab, graph No. 47 ; *jowar* in the Central Provinces, graph No. 50 ; *bajra* in Bombay and Sind, graph No. 54 ; linseed in the Central Provinces and Berar, graph No. 67 ; cotton in Bombay and Sind, graph No. 79 ; and cotton in the Central Provinces and Berar, graph No. 80).

Similarly, 1912-13 was a good year, but 1913-14 a poor one (for *bajra* in the United Provinces, graph No. 57 ; linseed in the United Provinces, graph No. 68 ; and sesamum in the United Provinces, graph No. 71).

(4) Where there are considerable fluctuations from year to year in crops, these are most marked in crops dependent on rainfall, e.g. *jowar* and *bajra* in the various provinces.

(5) The effect of the world slump of 1929-30 began to be keenly felt from 1930-31 in India when prices of agricultural commodities in general dropped heavily. The low level of prices continued up to 1933-34 after which recovery started. The slump in prices had comparatively little effect on the level of agricultural production. If at all, the production of major oilseeds and food-grains showed slight increases as is shown by the figures given below :

	Production of		
	Major food-grains	Major oil-seeds	Major fibre crops
	Million tons	*Million tons*	*Million tons*
1925-26 to 1929-30 ..	46·9	3·7	2·4
1930-31 to 1933-34 ..	48·6	3·9	1·9
1934-35 to 1938-39 ..	46·4	3·7	2·0

E. ALL-INDIA ACREAGE AND PRODUCTION

The figures of acreage and production discussed so far in this chapter relate to British India only as stated on page 2. Most of the graphs and statements, however, show all-India *acreages* also. These relate to British India *plus* the following 66 States for which figures of area are available from *Agricultural Statistics of India*, volume II, from 1920-21 to 1937-38.

(*a*) (1) Baroda.

(*b*) *Bombay States* of (2) Aundh, (3) Bhavnagar, (4) Dharmpur, (5) Jath, (6) Phalton and (7) Sachin.

(*c*) *Central India States* of (8) Barwani, (9) Bhopal, (10) Indore, (11) Nagod, (12) Narsingarh and (13) Rajgarh.

(*d*) (14) Gwalior State

(*e*) (15) Hyderabad State.

(*f*) (16) Kashmir State.

(*g*) *Madras States* of (17) Banganapalle, (18) Cochin, (19) Puddukkottai, (20) Sandur and (21) Travancore.

(*h*) (22) Mysore State.

(*i*) Punjab States of (23) Bahawalpur, (24) Bilaspur, (25) Dujana, (26) Faridkot, (27) Jind, (28) Kalsia, (29) Kapurthala, (30) Loharu, (31) Malerkotla, (32) Nabha, (33) Pataudi, (34) Patiala, (35 to 51) Simla Hill States and (52) Sirmur.

(*j*) *Rajputana States* of (53) Alwar, (54) Bharatpur, (55) Bikaner, (56) Bundi, (57) Dholpur, (58) Jaipur, (59) Jhalawar, (60) Kishangarh, (61) Kotah, (62) Marwar and (63) Tonk.

(*k*) United Provinces States of (64) Benares, (65) Rampur and (66) Tehri-Garhwal.

The total area of all the 66 reporting states named above amounts to 257,579,000 acres with a population of 46 millions. These states represent 56 per cent of the total area and 67 per cent of the population of the Indian states.

In the case of certain commodities, however, data for a larger area are also available from the *Estimates of Area and Yield*. In the case of such crops total acreage and total production of all the tracts have been shown in the graphs as 'total all-India acreage' and 'total all-India production'. The relevant figures are set out in statements 98 to 104 in the appendix. Even these figures do not appear to be quite complete for India as a whole as will be indicated by the following figures regarding linseed:

	Production according to the Report on the Marketing of Linseed in India	*Production according to the Estimates of Area and Yield only*
	Thousand tons	*Thousand tons*
1925-26	466	427
1926-27	473	436
1927-28	422	377
1928-29	401	352
1929-30	422	421
1930-31	440	416
1931-32	476	454
1932-33	504	440
1933-34	458	402
1934-35	492	448
1935-36	478	416
1936-37	475	445

Statement (for British India only) showing average acreage and production together with their standard deviations of certain commodities. (The limits within which the acreage and production figures will normally vary are the so-called 'fiducial' limits, i.e. the average plus or minus twice the standard error)

	Average acreage (Million acres)	Standard deviation	Average production (Million tons)	Standard deviation
Rice	68·0	1·5	25·4	2·5
Wheat	24·7	0·5	7·8	0·8
Barley	6·9	0·2	2·6	0·4
Jowar	21·3	1·0	4·6	0·6
Bajra	13·4	1·0	3·2	0·2
Maize	5·8	0·6	2·1	0·2
Gram	13·6	2·5	3·5	2·1
Ragi etc.	34·4	1·3	..	..
Linseed	2·9	0·5	391 (000 tons)	83·7
Sesamum ..	3·3	0·3	316 (000 tons)	38·4
Rape and Mustard ..	6·0	0·5	1·0 (M. tons)	0·4
Condiments ..	1·4	0·1	..	..
Cotton	14·4	1·5	578 (000 tons)	94·1
Other fibres ..	749 (000 acres)	95·0	..	..
Coffee	94 (000 acres)	1·8	9 (000 tons)	1·8
Tobacco	1,075 (000 acres)	69·0	442 (000 tons)	23·0

Chapter II—GROW MORE-FOOD-CAMPAIGN

The story of the Grow-More-Food Campaign has been recorded in the printed statement issued by the Department of Education, Health and Lands, entitled *Grow-More-Food Campaign, What it has achieved in* 1942-43 *Crop Season and What it hopes to achieve during* 1943-44 *Crop Season*. Statements 1 to 4 are particularly illuminating as regards the all-India results so far as rice, wheat, *kharif* crops and cotton are concerned. In addition, the tables at the end of this chapter (prepared by Directors of Agriculture on forms sent out by Mr. H. R. Stewart) give additional information as regards individual provinces and concerning several other crops. A study of the printed statement of the Education, Health and Lands Department, of the tables from the provinces and states and of the letters accompanying them and of certain other correspondence with the provinces and states brings out the following points:

(1) In the case of those provinces which have replied to a query sent out by me, there was in 1942-43, not only a switch-over from cotton to food crops, but also an absolute total increase in the area cultivated. In the Central Provinces, this increase was 347,000 acres (on a 1941-42 total of 26,527,000). In Bengal the increase was 1,467,000 acres (on a 1941-42 total of 25,488,400). In Assam the increase was 582,940 acres (on a 1941-42 total of 7,252,524 acres). In the United Provinces the increase was 820,000 acres (on a 1941-42 total of 35,545,000). In the Bombay Province during 1942-43 the total cropped area (including cotton) was 28,762,576 acres against 29,453,207 acres in 1941-42. The decrease of 690,631 acres was mainly in the eastern parts of the Deccan and Karnatak and was due to inadequate rain. The Director of Agricultural Production (Food) reports that for rice, wheat, groundnut, sugarcane, castor, sesamum, linseed, rape and mustard the 1941-42 figure (for all the British provinces *plus* the Indian states, excluding Hyderabad, Kashmir and a few smaller states) was 1'35,018,000 acres, while the 1942-43 figure was 138,407,000 acres, an increase

of 8,389,000. For the same years the cotton acreages were 24,151,000 and 18,812,000 acres (a decrease of 5,339,000 acres).

(2) So far as increased production of any crop is concerned, we have to consider two factors: (*a*) increased acreage, and (*b*) increased yield per acre. It is not possible to attribute the whole, or perhaps even the major part of increased yield per acre in 1942-43 where such exists, to the Grow-More-Food campaign, since the effect of season is very marked. This is particularly so in cases where the acreage has remained nearly stationary or diminished but the yield has increased, as for example:

		Acreage Per cent	*Production* Per cent
Gram (Bombay Province)	..	—3	+10
Wheat (United Provinces)	..	—3·88	+3·48
Bajra (United Provinces)	..	+1·56	+34·30
Wheat (Central Provinces)	..	—10	+32
Barley (Central Provinces)	..	—5	+18

These are instances of very favourable seasonal conditions.

On the other hand, there are a few cases where acreage has remained nearly the same or increased but yield has decreased, e.g.:

		Acreage Per cent	*Production* Per cent
Rice (Bengal)	.. ..	—2·30	—28·90
Bajra (Sind-British Districts)	..	+7	—3
Maize (Punjab)	.. ..	+7	—5
Rice (Orissa)	.. ..	+3	—9

These are instances of unfavourable seasonal conditions.

The alterat on in acreage (both in absolute amount and in the switch-over from cotton to food crops) is largely the result of propaganda, i.e. persuasion *plus* certain benefits, unaccompanied by legislative compulsion. The season 1943-44 will provide a test as to whether such persuasion can prevail against the temptation of high prices for cotton. In Baroda and Navanagar states, there is, in the current year, legislative compulsion to prevent the cotton area against increasing but these are isolated instances of such action. The fact, however, remains that the non-compulsory measures taken did, in fact, produce a considerable change-over from cotton to foodgrains.

A circular letter sent to Directors of Agriculture of provinces and states asking which three methods were considered most effective in increasing growth of food and in what order, brought replies of which the following is an analysis:

(Eight Directors replied)

Method employed	*Places allotted*	*Total*
Measures involving water-supply (irrigation concessions, etc.) ..	3 firsts 2 seconds 1 third	6
Measures involving manure supply	No first, 3 seconds 2 thirds	5
Measures involving seed supply ..	3 firsts 3 seconds 1 third	7
Propaganda and organization ..	3 firsts no second 1 third	4
		22

There should have been a total of 24 votes, but two Directors nominated first and second places only. That water-supply should rank high is not surprising. The high rank of seed supply is presumably because it is easier to carry out than manure supply. The high place given by three out of the eight Directors to direct propaganda (talks, ballads, etc.) is an indication that when this sort of thing is well done it is very effective.

The Grow-More-Food campaign in the year under review was by its very nature improvised and uncoordinated. We have certain gross figures which are given in the tables already quoted and we have some detailed pictures of the working of the campaign in the reports of certain provinces and states. But we have no figures to indicate what particular increases in acre-yields were obtained by the application of manures and additional water and how these increased outturns compared in value with the expenditure incurred to produce them. It is desirable that some such data should be obtained and that the data should be accurate, i.e. vouched for by those who actually did or supervised the work. The same type of data is required for each season—*kharif* or *rabi*—as long as the Grow-More-Food campaign lasts. It is not suggested that attempts should be made to collect these over large areas. It would be much better to have small reliable samples taken from places scattered widely over typical regions.

So far as increasing or reducing acreage, the working of the jute restriction legislation in Bengal is the most outstanding example. The following is a short account of its history and effects, prepared at my request by Mr Carbery, Director of Agriculture, Bengal:

'As a corollary of the world-wide depression of 1930-31, the prices of jute dropped to a very low figure. To meet the situation the Government of Bengal attempted by propaganda to voluntary restricting the acreage under this crop. This began in the year 1932-33. It was carried on for several years, but it was generally recognized that this voluntary campaign was not a success.' The following table prepared by Mr Das Gupta, Secretary, Indian Central Jute Committee, bears this out:

Season	Extent of voluntary reduction advised by Government	Acreage sown in Bengal (final forecast figures in thousand acres)
1934-35 ..	Nil	2,348
1935-36 ..	5/16 of acreage in 1934-35 ..	1,918*
1936-37 ..	1/3 of acreage in 1934-35 ..	2,251
1937-38 ..	3/16 of acreage in 1934-35 ..	2,209
1938-39 ..	Same as in 1937-38 ..	2,522
1939-40 ..	2/16 of acreage in 1937-38 ..	2,550

*Bad weather during sowing season was partially responsible for the reduction.

'In the year 1940 the Jute Regulation Act was passed by the Bengal Legislative Assembly and was followed by the Bengal Raw Jute Taxation Act, 1941. Under this Act a small cess was placed on jute, equivalent to 2 annas on every

maund of raw jute purchased by a mill or sent outside Bengal. This paid for a very large staff known as the jute regulation staff. In 1940 it was widely advertised that all land under jute would be registered, but there was no restriction On the basis of this registration in 1940, taking the acreage as 16 annas the Government of Bengal have since through their jute regulation staff issued licences for whatever percentage they decided on for the forthcoming year. In the year 1941 this was put down as 5 annas of the 1940 acreage. In 1942 this acreage was increased to 10 annas, subsequently reduced to 8. In the present year (1943) the licensed acreage is 8 annas of the 1940 acreage. The jute regulation staff, apart from issuing licences, checked up on the acreage under jute and those who have sown in excess of their licence have been prosecuted. In some cases the land has been actually ploughed up.

Generally speaking, this licensing of jute areas has been a success. It has achieved the object for which it was brought in, namely, to give the cultivator a fair return for his produce. In the present year an unforeseen thing has happened owing to the high prices and shortage of paddy and rice. It is believed that the jute cultivator has not put all of his licensed area under jute, but some of it has been put under paddy. This is purely a result of the war, and is not likely to recur when normal times return.'

Conclusion

So far as the Grow-More-Food campaign methods and results are concerned the questions which Chapter II set out to answer have been dealt with above, with the exception of the question, 'At what cost were these (results) obtained' (taking into account both the central and provincial expenditure).

From the data provided, it has proved impossible to answer this question. This is due to the following facts:

(1) Some of the expenditure was in the form of loans, to be used over a period.

(2) Some of the measures undertaken have probably not yet taken effect, and, when they do, will have a long-term effect, e.g. well-digging.

(3) Some of the measures were reductions in existing rates for such items as irrigation, well-boring, collection of green manure in forests, and oil-cakes.

(4) Some dealt with free distribution of items such as seeds.

(5) Some items consisted of the waiving of interest on *taccavi* loans.

The effect of jute restriction has been discussed above, and of the sugar tariff in Chapter I under the heading Sugarcane (all-India).

The general conclusions to be drawn are that, within fairly wide limits acreage and production have been influenced and can be influenced by measures deliberately framed to that end. A combination of persuasion, concessions and compulsion is doubtless the best procedure, and compulsion is particularly necessary if immediate profit is likely to interfere with national policy.

1. *Assam Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecast) compared with the corresponding area and production in 1941-42

Crop	Final forecast 1941-42		Final forecast 1942-43		Estimated increase in 1942-43 over 1941-42		Percentage increase in 1942-43	
	Acreage	Production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Rice	4,611,400	1,473,265	5,107,700	1,643,485	166 300	170,220	10·04	11·55

2. *Bengal Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		Final forecast, 1942-43		Estimated increase in 1942-43 over 1941-42		Percentage increase in 1942-43	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	170,000	38,300	178,600	53,100	+8,600	+14,800	+5	+37
Barley	102,800	33,200	135,600	44,800	+33,000	+11,600	+27	+34·94
Gram	327,100	92,600	427,900	130,300	+100,800	+37,700	+30·81	+40·71
Rice	23,343,000	9,809,400	22,293,900	6,974,300	—649,100	—2,835,600	—2·30	—28·90
Maize	92,400	28,900	122,200	32,800	+29,800	+3,900	+32·25	+13·50
Bajri	2,100	700	1,200	300	—900	—400	—42·86	—57·14
Jowar	6,300	1,900	10,700	2,800	+4,400	+900	+69·84	+47·37
Total ..	24,543,500	10,005,000	24,170,100	7,239,400	—367,400	—2,767,500	—1·5	—27·7

3. *Bihar Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		Final forecast, 1942-43		Estimated increase in 1942-43 over 1941-42 (*b*)		Percentage increase in 1942-43 (*b*)	
	Actual Acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	1,300,000	484,600	1,280,100	581,200	—19,900	+96,600	—1·53	+19·93
Barley	1,284,300	446,300	1,269,100	416,000	—15,200	—30,300	—1·18	—6·79
Gram	1,448,600	529,500	1,446,500	468,400	—2,100	—61,100	—0·14	—11·54
Rice (*a*)	8,869,700	2,747,200	9,291,200	3,256,200	+421,500	+509,000	+4·75	+18·53
Maize	1,461,200	456,300	1,651,900	558,300	+190,700	+102,000	+13·05	+22·35
Bajri	60,100	22,700	60,100	22,300	..	—400	*Nil*	—1·76
Jowar	73,000	18,500	73,300	18,800	+300	+300	+0·41	+1·62
Marua	548,500	161,200	543,300	159,700	—5,200	—1,500	—0·95	—0·93
Arhar	367,400	126,200	319,100	102,100	—48,300	—24,100	—13·15	—19·10
Total ..	15,412,800	4,992,500	15,934,600	5,583,000	+521,800	+590,500	+3·39	+11·83

(*a*) Includes summer, autumn and winter rices.
(*b*) *Minus* figures denote decreases.

4. *Bombay Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts) compared with actuals in 1941-42

Crops	1941-42		Final Forecast estimates 1942-43		Estimated increase or decrease in 1942-43 over or below 1941-42		Percentage increase or decrease in 1942-43	
	Actual Acreage	Production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	1,563,887	245,071	1,300,400	214,789	—263,487	—30,282	—16·8	—12·4
Barley	13,744	4,093	(a) 12,000	(a) 3,000	—1,744	—1,093	—12·7	—26·7
Gram	515,664	70,005	(a) 500,000	(a) 77,000	—15,664	+6,995	—3·0	+10·0
Rice	1,915,370	634,643	2,047,274	927,604	+131,904	+292,961	+6·9	+46·2
Maize	180,669	56,001	173,748	35,461	—6,921	—20,540	—3·8	—36·7
Bajri	3,822,111	456,486	5,022,307	642,322	+1,200,196	+185,836	+31·4	+40·7
Jowar (kharif)	2,620,431	508,308	2,718,037	572,668	+97,606	+64,360	+3·7	+12·7
Jowar (rabi)	5,908,460	663,673	4,740,217	467,633	—1,168,243	—196,040	—19·7	—29·5
Ragi	598,724	154,086	613,720	196,033	+14,996	+41,947	+2·5	+27·2
Kodra	181,696	45,992	201,518	77,001	+19,822	+31,009	+10·9	+67·4
Tur	380,118	91,007	434,042	105,756	+53,924	+14,749	+14·2	+16·2
Total ..	17,700,874	2,929,365	17,763,263	3,319,267	+62,389	+389,902	+0·4	+13·3

(a) Represent very rough estimates as no forecasts are issued on these crops.

5. *The Central Provinces and Berar*

Forecasted area and production of the principal foodgrain crops in 1942-43 compared with the actuals in 1941-42

Crops	1941-42		Final Forecast, 1942-43		Estimated increase in 1942-43 over 1941-42		Percentage increase in 1942-43	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	2,850,589	389,600	2,565,311	513,200	—285,278	+123,600	—10	+32
*Barley	10,037	1,625	9,534	1,930	—503	+305	—5	+18·7
*Gram	1,116,504	157,400	1,003,077	168,096	—113,427	+10,696	—10	+6·7
Rice	5,757,479	891,600	5,799,130	1,865,100	+41,651	+973,500	+1	+109
*Maize	150,254	68,250	151,270	75,533	+1,016	+7,283	+0·7	+10
*Bajra	107,052	22,500	118,681	26,982	+11,629	+4,482	+10	+20
Jowar	4,739,390	975,800	5,361,214	1,140,300	+621,824	+164 500	+13	+17
*Masur	324,229	40,900	299,374	41,947	—24,855	+1,047	—8	+2
*Kodon-kutki	1,676,739	143,100	1,705,404	161,700	+28,665	+18,600	+1·7	+13

*No forecastes are issued for barley, gram, maize, bajra, masur and kodon-kutki crops.

Note.—The area and production figures are as supplied by the Director of Land Record's Office.

6. *Madras Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		1942-43		Estimated increase (+) or decrease (—) in 1942-43 as compared with 1941-42		Percentage increase (+) or decrease (—) in 1942-43 as compared with 1941-42	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent.
Rice	10,212,422	4,055,300	10,394,000	4,674,900	+181,578	—380,400	+1·8	—7·7
Bajra	2,492,181	640,350	2,592,200	562,100	+100,019	—77,950	+4·0	—12·2
Jowar	4,904,941	1,214,070	4,706,400	1,033,700	—198,541	—180,370	—4·0	—14·9
Ragi	1,813,534	823,560	1,773,900	693,700	—39,634	—129,860	—2·3	—15·8
Black gram	215,253	26,400	231,500	26,500	+16,247	+100	+7·5	+15·6
Green gram	422,133	40,700	432,000	39,000	+30,163	—1,700	+7·2	—0·04
Redgram	260,716	36,700	306,000	36,000	+36,234	—700	+13·4	—0·02
Wheat	13,219	No forecasts are issued. The crops are of minor importance in this Province.						
Barley	1,921							
Maize	85,727	26,970	No forecasts are issued.					
Bengal gram	58,124	11,740						

7. *North-West Frontier Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		Final forecast, 1942-43		Estimated increase in 1942-43 over 1941-42		Percentage increase in 1942-43	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	1,059,357	257,500	1,114,300	273,000	54,943	15,500	5·2	6·02
Barley	202,996	44,250	..	..	..	..	..	..
Gram	141,115	13,300	..	..	..	..	..	..
Rice	30,579	14,700	35,171	..	4,592	2,548*	15·0	17·2*
Maize	469,444	201,600	481,708	..	12,264	4,057*	2·6	2·01*
Bajra	158,142	(a) 18,000	182,831	..	24,689	5,005*	15·6	26·5*
Jowar	96,367	11,600	109,516	..	13,149	1,982*	13·6	17·1*
Total ..	2,158,000	561,850	..	..	9,637	29,092	10·4	13·72

Note.—
(a) Normal yield for *bajra* should have been 32,037 tons. This yield realized was much below the normal.
*Based on normal outturn per acre.

8. *Orissa Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		Final forecast 1942-43		Estimated increase over (+) or decrease from (—) 1941-42		Percentage increase over (+) or decrease from (—) 1941-42	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	3,900	1,381	4,000	1,375	+100	—6	+3	Less than 1 per cent.
Barley	400	33	400	33	..	..	..	..
Gram[1]	3 000	1,000	3,033	1,003	+33	+3	+1	Less than 1 per cent.
Rice[2]	4,985,200	1,378,894	5,055,200	1,246,913	+170,000	—131,981	+3	—9
Maize	28,200	6,318	28,700	6,881	+500	+563	+2	+9
Bajra	5,500	803	12,000	1,257	+6,500	+454	+118	+57
Jowar	39,200	3,492	38,600	3,394	—600	—98	—2	—1
Ragi or Mandia[3] ..	265,000	63,064	269,300	61,880	+4,300	—1,184	+2	—2
Bhadai cereals and pulses ..	199,100	59,280	201,600	63,894	+2,200	+4,614	+1	+8
Rabi cereals and pulses ..	413,700	123,903	403,800	92,182	—9,900	—31,720	—2	—26
Total ..	5,943,500	1,642,173	6,016,633	1,483,812	+73,133	—159,361	+1	—9

Note—[1]Though the area increased the outturn was affected on account of unfavourable weather.
[2]The increase in area could not help the increase of production as the outturn was considerably affected by severe cyclone in October and November 1942.
[3]The outturn expected decreased on account of deficiency of timely rainfall.

9. *The Punjab Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 (according to final forecasts in all cases) compared with actuals in 1941-42

Crops	1941-42		Final Forecast, 1942-43		Estimated increase in 1942-43		Percentage increase in 1942-43	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	10,008,100	3,873,000	10,284,000	4,056,200	275,900	183,200	+3	+5
Barley	804,300	326,600	908,700	272,700	104,400	46,100	+13	+29
Gram	3,461,200	618,700	4,664,900	1,074,400	1,203,700	425,700	+35	+65
Rice	801,700	297,600	1,096,600	384,300	294,900	86,700	+23	+32
Maize	1,197,900	463,400	1,274,200	442,700	86,300	—20,700	+7	—5
Bajra	3,704,900	442,600	4,134,500	613,600	429,600	201,000	+12	—45
Jowar	772,100	94,300	882,661	Not available till August.	110,300	Available from D. L. R. in August.	+14	..
Total ..	20,830,200	6,046,200	23,245,300	(a) 6,873,900	2,415,100	(a) 922,000	+11·6	(a) +16

(a) Does not include production of *jowar* whose area has increased by 14 per cent.

	Cotton area reduction							
	Acres	Bales	Acres	Bales				
American cotton ..	1,567,100	806,600	1,575,400	703,900	+18,300	—12,700	+1	—2
Desi cotton	1,244,000	420,400	756,300	276,800	—487,700	—140,600	—39	—33
Total cotton ..	2,801,100	1,227,000	2,331,700	1,073,700	—469,400	—153,300	—17	—12

10. *Sind Province*

Forecasted area and production of the principal foodgrain crops in 1942-43 according to final forecasts in all cases) compared with actuals in 1941-42

Name of grain	1941-42		Final Forecast, 1942-43		Estimated increase in 1942-43 over 1941-42		Percentage increase in 1942-43	
	Actual acreage	Official production	Acreage	Production	Acreage	Production	Acreage	Production
British districts	(Acres)	(Tons)	(Acres)	(Tons)	(Acres)	(Tons)	Per cent	Per cent
Wheat	1,191,503	367,910	1,332,892	443,234	+141,389	+75,324	+12	+20
Rice*	1,377,899	442,831	1,315,653	322,303	—62,246	—120,531	—5	—27
Bajri	772,476	134,711	824,818	130,096	+52,342	—4,618	+7	—3
Jowar	474,626	116,366	528,531	127,911	+53,905	+11,545	+11	+9
Total ..	3,816,504	1,061,824	4,001,894	1,023,544	+185,390	—38,280	+5	—4
Khairpur State								
Wheat	96,265	31,305	125,366	40,293	+29,091	+8,755	+30	+28
Rice	6,940	44,758	6,378	41,134	—562	—3,624	—8	—8
Bajri	11,800	1,990	4,477	757	—7,323	—1,233	—62	—62
Jowar	92,106	19,668	87,166	18,613	—4,940	—1,055	—5	—5
Total ..	207,111	97,921	223,377	100,797	+16,266	+2,876	+8	—3
Grand Total ..	4,023,615	1,159,745	4,225,271	1,124,341	+201,655	—35,404	+5	—3
Barley	12,818	3,057	..	..	..	..	..	..
Gram	310,041	54,967	..	..	..	..	..	..
Maize	2,806	1,002	..	..	..	..	..	..
Total ..	356,365	59,026	..	..	..	..	..	..

+=Increase
—=Decrease

*Rice—The 27 per cent decrease in production against 5 per cent increase in area is due to the fact that considerable area came under floods in 1942-43. The areas grown under rice and subsequently flooded are not excluded. Forecasts are not issued on barley and maize crops.

11. *The United Provinces*

Table showing acreage (in thousands of acres) and production (in thousands of tons) of important foodgrain crops for 1941-42 and 1942-43

Crops	1941-42		1942-43		Actual increase (+) or decrease (—) in 1942-43 over 1941-42		Percentage increase (+) or decrease (—) in 1942-43 over 1941-42	
	Acreage	Production	Acreage	Production	Acreage	Production	Acreage	Production
Wheat	7,724	2,556	7,424	2,645	—300	+89	—3·88	+3·48
Barley	4,016	1,210	4,217	1,508	+201	+298	+5·00	+24·63
Gram	5,289	1,417	5,553	1,765	+264	+348	+4·99	+24·56
Rice	6,107	1,500	6,891	1,767	+784	+267	+7·55	+17·80
Maize	1,920	594	2,407	941	+487	+347	+25·36	+58·42
Bajra	2,053	481	2,999	646	+46	+165	+1·56	+34·30
Jowar	2,129	388	2,662	656	+533	+268	+25·04	+69·07
Total ..	30,438	8,146	32,153	9,923	+1,715	+1,782	+5·63	+21·88

Chapter III—POTENTIALITIES

1. Rice

It is unnecessary to emphasize again the great number of rice varieties grown and the great number of ways in which rice is cultivated in different parts of India. The present question is the increase of yield and the following remarks deal with that point:

The Report on the Marketing of Rice in India and Burma, 1941, gives the following table based on the results of actual crop-cutting experiments conducted in the provinces mentioned:

Average outturn of paddy (rice in the husk)

	Irrigated (lb. per acre)	*Unirrigated* (lb. per acre)
Madras	1,694	1,138
Central Provinces and Berar ..	1,200	900
United Provinces	1,100	850
Punjab	1,269	587

The all-India average (got by dividing the yield expressed in pounds by the acreage) is as follows during the last five years:

	In terms of rice (lb.)	*Converted into paddy (at 66 per cent)* (lb.)
1938-39	731	1,098
1939-40	776	1,165
1940-41	680	1,021
1941-42	772	1,159
1942-43	734	1,102
Average of the five years ..	738	1,109 lb. paddy per acre

In India the yields vary considerably from place to place and from province to province as has already been shown in the table given above. In Coorg the ordinary cultivator manages to produce about 1,900 lb. paddy per acre and a certain well-managed Indian estate in Coorg produces 3,800 lb. per acre. In addition to suitable soil and climate the main factors in high yield are (*i*) use of a high-yielding variety, and (*ii*) manure and water. Plant-breeders have produced in all the rice-growing provinces varieties which yield from 10 to 25 per cent more than the local types which they are intended to replace.

Until a few years ago the spread of these new varieties was meagre and it was estimated at only 6 per cent of the total rice area. This situation was considered by the Imperial Council of Agricultural Research in its Rice Committee and its full Advisory Board and a scheme was devised whereby, within two years, under intensive multiplication, a very large area was to be put under these improved varieties. Following this up in 1941, the Governing Body of the Imperial Council of Agricultural Research allotted Rs. 1,10,000 to be spent in two years for rice schemes, primarily for developing rice cultivation, i.e. introducing improved seed and better cultural practices so as to increase the outturn per acre. It was hoped by this means greatly to increase the areas under improved rice varieties in certain rice-growing provinces, Madras, Bengal, the United Provinces, the Central Provinces and Orissa. This scheme has been somewhat overshadowed by the Grow More Food drive which aims at increasing acreage and yield of any

variety whatsoever but the participating provinces are continuing with the schemes as a part of an auxiliary to their Grow More Food campaigns.

Given ample water and ample manure there is no doubt that, throughout the whole of India, rice yields can be forced very much higher. Manurial experiments carried out in many places and over many years throughout India indicate that Indian yields can be increased very much if fertilizers are available. Increases may be anything from 20 to 150 per cent according to the variety, soil, climate and season. In the Central Provinces, for example, a dressing of 250 lb. of bone meal and 50 lb. of sulphate of ammonia increased the yield of paddy from 515 lb. per acre to 1,149 lb. per acre, an increase of 128 per cent. In Orissa 110 lb. bone meal in conjunction with green manuring increased the yield from 970 lb. to 1,500 lb., an increase of 54 per cent. At Ratnagiri in the Bombay Province, a dressing of 40 lb. of castor cake per acre increased the yield from 1 250 lb. to 1,670 lb., an increase of 33 per cent. At Pattambi in Madras *neem* cake sufficient to supply 30 lb. nitrogen *plus* sulphate of ammonia sufficient to supply 15 lb. nitrogen increased the yield from 1,481 lb. per acre to 1,806 lb. per acre, an increase of 22 per cent. These are only a few examples from a very long record. The important thing is that fertilizers must be cheap relatively to the value of increased produce, i.e. *the additional paddy produced by the use of fertilizers.*

At Sabour in Bihar, experiments carried on over three years showed that 100 lb. of sulphate of ammonia containing 20 lb. of nitrogen gave an increase of 466 lb. of paddy per acre. Paddy was then selling at Rs. 2 per 80 lb. The increased price of this grain was Rs. 11-10-4, cost of the manure was Rs. 5-5-0 the increase of straw of 869 lb., valued at Rs. 2-11-5; so the net profit on the manuring was Rs. 9. Oil-cakes and green manure gave similar results, and it is largely a matter of choosing a manure for the paddy crop which is the most available and the most economical. Rice needs phosphorus as well as nitrogen, and where this has been added either as bone meal or superphosphate, still further increases have been obtained.

It is obviously not economical to manure if the price of the manure added is going to be greater than the value of the additional paddy obtained.

Mr E. F. Sykes of the Bundi Agricultural Syndicate, Ltd., has carried out for the last three years experiments on rice manuring on his farm near Bundi. The general results are that for every 60 lb. of sulphate of ammonia added, there is an addition of 4 maunds of paddy (approximately 330 lb. per acre). This holds up to 180 lb. sulphate of ammonia per acre. Even with sulphate of ammonia at a very heavy price, i.e. Re. 0·6 per lb. of nitrogen or Rs. 269 per ton (i.e. Rs. 13·44 per cwt.) such manuring was profitable, with paddy selling at Rs. 4 per maund giving a profit of Rs. 26·52 per acre and with paddy at Rs. 5 per maund gave a profit of Rs. 38·55 per acre. Similar results were got by giving similar amounts of nitrogen as castor cake.

Experiments on the economics of fertilizing paddy with sulphate of ammonia carried on over many years by the Imperial Chemical Industries throughout India show almost everywhere both a very marked effect of the fertilizer and a good return on fertilizer expenditure. Experiments carried on in Bengal between 1936 and 1939 show the average increase in yield from applying one maund (80 lb.) sulphate of ammonia to have been 4·01 maunds (80 lb.) grain and 9·45 maunds straw, with the dressing of 1¼ maunds (80 lb.) costing Rs. 7-4-0 giving an increase of 6 maunds grain and 14·18 straw. Valuing the paddy at Re. 1-11-0 per maund (80 lb.) and the straw at 3 annas a maund (80 lb.), the value of the increased yield was Rs. 12-13-0, the net profit per acre being Rs. 5-9-0 and the

return on fertilizer expenditure 76 per cent. Even if the paddy had sold as low as Re. 1-6-0 per maund (80 lb.) there would still have been a 50 per cent profit on the fertilizer expenditure.

In other parts of India, the average increase in yield from applying one maund (80 lb.) sulphate of ammonia, varied from 1·99 maunds paddy in the Punjab to 4·42 maunds in Madras. For the whole of India (the average of 34 centres) where experiments were carried out between 1933 and 1939, the average increase in yield from applying one maund (80 lb.) of sulphate of ammonia was 3·44 maunds (80 lb.) grain and 7·26 maunds (80 lb.) straw. The cost of the fertilizer, applied 1½ maunds (80lb.), was Rs. 7-5-0. The value of the produce per maund (80lb.) was taken as Rs. 2-4-0 per maund grain and 4 annas per maund straw, the value of increased yield was Rs. 14-6-0. the net profit per acre Rs. 7-1-0 or 97 per cent on the fertilizer expenditure. Even with the paddy selling at Re. 1-10-0 per maund (80 lb.), there would have been a return of 50 per cent on the fertilizer expenditure.

There is therefore everything to be said for the increasing and cheapening of supplies of all types of oil-cakes and of bone meal and for the encouraging of green manuring previous to the planting of rice crops. The actual manures to be given and their quantities must be determined by the Agricultural Department of each province or state for its own particular climatic, geographical, industrial and price conditions, but the information exists and has only to be applied.

Taking India as a whole we shall take the conservative figure of a probable increase of 30 per yield per acre of which we shall consider 5 per cent due to improved variety, 20 per cent due to increased manuring and 5 per cent due to protection from certain pests and diseases. The manuring later suggested is capable of giving at least a 40 per cent increase and the improved varieties could give a 10 per cent increase; but these figures are halved to make the estimate conservative. Averaging the all-India area and yield for the years 1924-25 to 1940-41 to the nearest hundred thousand acres and tons we get an area of 76,000,000 acres and 28,000,000 tons. An increase of 30 per cent on this would be an addition of 8,400,000 tons or a total of 36,400,000 tons, a figure which has not been reached even in peak years though in 1917-18, the all-India total may be estimated at about 33,000,000 tons.

To get this result we assume (i) the use of no seed except that of high-yielding varieties, to be made available under comprehensive seed schemes. Each seed scheme would be based on the plant breeder's plot, the seed being multiplied first at the Government farms and then on the farms of registered growers.

To get this amount of seed it is obvious that there would have to be more than one series of registered growers, probably at least three such series, the later series getting their seed from earlier ones, the whole process being supervised right through with the necessary rogueing of the crop in the field, buying and storing all the seed at each stage and final distribution to the cultivator. The cultivator is rarely prepared to pay more than ordinary market rates even for improved seed (though there have been exceptions to this) and while the seed schemes are developing they would have to be subsidized by grants to registered growers and for storage and transport somewhat in the manner devised for the already mentioned Imperial Council of Agricultural Research schemes for the quick spread of improved rice varieties.

As regards adequate supply of manure, let us assume manuring equal to one ton of any type of oil-cake to five acres with an average nitrogen content

in the oil-cake of 5 per cent giving 22·4 lb nitrogen per acre (equivalent to one cwt. of sulphate of ammonia). For 76,800,000 acres this would mean 15,260,000 tons of total oil-cakes. The actual amount of all oil-cakes produced in India at the moment is not known. Considering oilseed production, it may be of the order of 3 million tons.

It is not, however, necessary or feasible to supply this nitrogen entirely as oil-cakes. It might be supplied partly as bone meal, partly as sulphate of ammonia, partly as farmyard manure or green manure.

Let us assume for the purpose of argument that the nitrogen supply for rice is divided equally between these five sources. Each of these sources will then have to supply the equivalent of 3,052,000 tons of oil-cakes. Let us assume the following nitrogen contents:

	Per cent
Bone meal	4
Sulphate of ammonia	20
Farmyard manure or compost	0·5 (a low estimate)
Green manure	0·7 (average for 40 varieties with 75 per cent moisture content).

We get the following tonnages required:

	Tons
Oil-cakes	3,052,000
Bone meal	3,815,000
Sulphate of ammonia	763,000
Farmyard manure or compost	30,520,000
Green manure	21,800,000

Insect pests: As regards reduction of pests and diseases, the chief insect pest in South, Central and Western India is the rice grasshopper, *Hieroglyphus banian*. This is most effectively dealt with by running large bags over the crop while young. Destroying the egg masses by scraping the *bunds* and ploughing up the fields during early summer months is also useful. This involves the making of bags and a certain amount of labour. The other important pests in India and their methods of control are:

(*i*), (*ii*) The swarming caterpillar and the army-worm (*Spodoptera mauritia* and *Cirphis unipuncta*). Practicable methods of control are the flooding of the infested nurseries. This brings up the hiding caterpillars which are eaten by birds. The use of trenches round the infested seed-beds to prevent the migration of the pests from one infested field to another is also useful.

(*iii*) The paddy stem borer (*Schaenobius species*). While transplanting, seedlings showing dead-hearts should be removed. Light traps attract a large number of female moths and thus reduce the population. The stubble after harvest should be ploughed up and destroyed because the pest lives as larva or pupa in this refuse and subsequently attacks the fresh crop.

(*iv*) The rice hispa (*Hispa armigera*). It is especially abundant in South India, Assam and Bengal. This beetle can be best controlled in the seedling stage when infested leaf tips which contain young stages can be clipped off before transplantation.

Other pests are the rice bug chiefly found in Eastern India and the paddy gall-fly common in Madras and Mysore.

Fungus diseases: There are two very important fungus diseases of rice which cause serious damage; two which cause less damage and several minor ones. Most serious is *Helminthosporium Oryzae*, which attacks leaves and seeds. It is partly seed-borne and partly air-borne. Disinfection of seed with mercurials reduces infection in the seedling stage, but mercurials are expensive and difficult to secure at present; so does immersion of the seed in hot water, though it is very risky to do it, owing to great danger of killing the seed, unless accurate machinery is used by skilled operators.

Blast, caused by *Piricularia Oryzae*, is serious in most parts of India. A rice variety known as Adt 6 has been found to be highly resistant in Madras, but the varieties Co4, Co11 and GEB 24, once thought to be highly resistant, are now found to be susceptible under certain conditions. In Assam the varieties Thabora and Zdulake are thought to be resistant. In Madras, when paddy has been sown in September, late-flowering varieties suffered less than early-flowering ones. Sowings made in November suffered less than those in September and October.

Fusarium moniliforme causes a serious foot-rot disease. The fungus *Ustilaginoidea virens* causes an infection of individual flowers resulting in replacement of the developing grain by a hard sclerotal mass. Neither of these diseases can be controlled by any methods known at present. Some minor diseases of rice are smut, caused by *Tilletia horrida*, leaf smut caused by *Entylema Oryzae*, and stem disease by *Ephelis Oryzae*.

Water: Improvement of water supply will vary immensely in its nature, cost and scope in different parts of India. In certain areas it will mean the extension of the existing canal system or the establishment of a new one. In others the digging of tube-wells, in others arrangements for pumping from rivers and in others the construction of simple reservoirs. So far as rice is concerned, the effect of such increased water supply would be more to extend the area under rice than to increase the acre yields. Even with the increases now mentioned India is a good way off the existing acre yield averages of certain other rice-growing countries, i.e. the estimated 36,400,000 tons cleaned rice got from 76,300,000 acres works out at 0·48 ton per acre. The average yields per acre of certain other countries are as follows:

Approximate yields of rice in important countries of the world
(lb. per acre)

	Average 1909—13	Average 1926-27 to 1930-31	Average 1931-32 to 1935-36	1936-37	1937-38	1938-39
India (including Burma) ..	982*	861	820	861	826	728
Burma	..	887	815	833	813	919
Indo-China	928†	961	937	..	..	..
Siam	..	1,017	961	863	829	913
United States of America ..	1,000	1,333	1,413	1,505	1,471	1,469
Italy	1,952	2,797	2,903	2,839	3,253	2,903
Spain	2,969	3,740	3,709	..	..	..
Egypt	2,119	1,847	1 799	2,093	2,001	2,153
Japan	1,827	2,121	2,053	2,039	2.305	2,276

*1914-15 to 1918-19. †1912-13 to 1913-14.

There is absolutely no reason why India should not aim at an average yield of 1,000 lb. cleaned rice per acre or a total production of the order of 34 million tons.

2. *Wheat*

Wheat presents agricultural and commercial problems different from those of rice. Wheat is a crop grown on an enormous scale by certain exporting countries as well as on a smaller scale by a great number of other countries. In the past there have been serious crises following years when the world production of wheat exceeded the possibilities of consumption. This resulted in a disastrous fall of prices. The bumper wheat year 1928-29 was followed in 1930 by the 'depression' with enhanced effects.

Exactly 10 years later (in 1938) a new high record was reached in the exporting countries due to an average yield on a record area and in the importing countries (including India) to a record yield on an average area.

In the Crop Planning Conference in India in 1934-35 it was considered that India should not attempt to produce more than 9½ million tons of wheat and there should be no stimulus to increased area. It is plain that the future of this crop in India will depend on world supplies and on India's policy regarding wheat.

For the immediate present, the need is for more wheat. The technological possibilities of producing this are as follows:

India has two main types of wheat—(1) *Triticum vulgare* or the soft bread wheats mainly grown in the Punjab, the United Provinces and Bihar, and (2) *Triticum durum*, macaroni wheats grown mainly in Bombay, the Central Provinces and Berar, and the Hyderabad State.

Yields: The following three tables, copied from the *Report on the Marketing of Wheat in India*, give the position as regards India and the outside world.

Standard yield for irrigated and unirrigated areas

(lb. per acre)

	Irrigated	Unirrigated
Punjab	967	572
United Provinces	1,200	800
Sind	937	734
Bombay	1,250	510

Average yield of wheat

(lb. per acre)

Punjab	738	Bombay	447
United Provinces ..	786	Sind	593
Central Provinces ..	444	Hyderabad	231
Bihar and Orissa ..	882	Gwalior	458
Central India ..	882		

Approximate yields in certain countries
(lb. per acre)

	Average 1924-33	Average 1909-13
United States	846	852
Canada	972	1,188
Australia	714	708
Argentina	780	596
Europe	1,146	1,110
Russia	636	612
India	636	724

What makes the greatest difference to wheat yields is undoubtedly irrigation. Wheats dependent only on the rainfall have a much lower yield. For example, in the Punjab, *barani* wheat gives a yield of only 560 to 800 lb. per acre, whereas irrigated wheat gives 960 to 1,280 lb. and may go much higher (e.g. in 1935 the B.C.G.A. at Khanewal got over 2,000 lb. per acre). In the Bombay province, dry cultiv ation of *durum* wheat gives 400 to 600 lb. per acre, whereas irrigated Pusa 4 whe at gave 1,300 lb. when grown in well-manured ground in a suitable rotation (Padegaon 1934-35).

Much depends also on good management and all it implies. On the Coleyana Estate in the Montgomery district of the Punjab, the average outturn per acre for the last 20 years has been 20 maunds per acre, while the average for the irrigated area in the Montgomery district has been only $11\frac{3}{4}$ maunds.

Wheat rust : A factor which reduces yields very much is rust, of which there are three types : black, red and yellow, each with several physiologic races, making it difficult to breed a wheat immune to all races of all the three types. Fortunately all three are not equally virulent everywhere and it is becoming possible to breed varieties which are fairly resistant to the local type of rust (black, brown or red) and its local races. Taken over the whole of India, the annual loss from rust is of the order of about 5 per cent in a year when there is no real rust epidemic but, in particularly badly affected places, it may be up to a 100 per cent. All the provinces which grow wheat have now a fair range of improved varieties. The following are examples of some of the varieties and t heir yields are against locals.

Triticum vulgare : Pusa bred wheats (now called I. P. wheats I. P = Imperial Pusa).

Experiments at Nawabganj and Raya (U. P.) in 1933-34 and 1934-35

Variety	Yields in lb. per acre 1933-34	1934-35	Remarks
Local ..	1,003	757	I. P. 120 and I. P. 165 are both highly rust-resistant. Their yields over the local varieties in these experiments are of the order of +50 to +150 per cent.
I. P. 120 ..	1,495	1,000	
I. P. 165 ..	1,687	1,097	
Raya			
Ummedpur ..	551	1,020	
I. P. 120 ..	2,153	1,763	
I. P. 165 ..	2,283	2,267	

Triticum durum: In the Bombay Province, Dr. Kadam some years ago evolved a wheat—a cross between *T. durum* and *T. dicoccum (Khapli)*—originally called 808 or Bansipalli and now called Jaya. This in dry conditions gives 800 to 900 lb. per acre against the local 400 to 600 lb. per acre. A still newer hybrid is Vijaya, which is 5 to 6 days later than Jaya and yields still more heavily. It is replacing the older wheats in the Nasik and Ahmednagar districts of the Bombay Province. Jaya and Vijaya are both fairly rust-resistant.

The I.C.A.R. is now subsidizing a research station at Powerkheda in the Central Provinces to produce similar high-yielding, rust-resistant, frost-resistant and drought-resistant strains of durum wheat.

In the Punjab, wheat-breeding has been carried on for a long time, one of their first winners, Punjab 8A, still widely cultivated as a general-purpose wheat. Of the newer wheats, C518, C591 and 9D are very good. Any of these will give from 15 to 40 per cent more grain than local according to circumstances.

Wheat smut: Loose smut of wheat can be effectively dealt with by rogueing out affected plants and applying to seed, before sowing, the hot-water treatment devised by Prof. Jai Chand Luthra of the Punjab Agricultural Department.

Wheat manuring: Like other manurial experiments in India, those on the manuring of wheat have been conducted in different places by different agencies at different times (and in certain cases at considerable intervals of time) and there is no uniform plan for the whole of India. At the same time, when one examines a great many of these experiments, one does get a fairly clear indication of the manurial requirements of wheat and of the kind of increase that may be expected from particular types of manuring.

In the very early experiments summarized by the Howards in Chapter VIII (Manurial Experiments) of their book, *Wheat in India* (1909), the following conclusions are given:

'It is clear that up to the present it has been found in India that given suitable soil moisture for germination and the subsequent growth of the crop, the limiting factor in the production of wheat is the supply of nitrogen in an available condition. This is best applied in the form of farmyard manure or cowdung which gives better results than saltpetre in the long run on account of the good influence of dung on the tilth and moisture-retaining power of the soil. Saltpetre, although a good manure, should only be occasionally applied as long continued application seems to do harm. Occasional green manuring with *sen* is to be recommended, but there is always a danger that the succeeding wheat crop may suffer through the loss of moisture entailed by the growth of this crop and its incorporation with the soil unless ploughed in at the proper time.'

The same series of records, so far as the Cawnpore experiments are concerned (including further data extending up to 1913-14), was re-examined later by R. J. Kalamkar and Sripal Singh. The plot containing cowdung which had received an average of 100 lb. nitrogen per acre, per annum, gave a mean yield of 1,805·8 lb. of grain as against 1,261·5 from the unmanured plot. In this experiment sulphate of ammonia was not used but sodium nitrate was given to one plot at the rate of 25 lb. nitrogen per acre. The mean yield of this was

1,475 lb. grain which as not *statistically significantly* higher than that of the unmanured plot. Two other important points arise, viz. (1) that there had been very little deterioration in the soil and the small amount which could be recognized appeared in the unmanured plot, the plot receiving sodium nitrate and that receiving sodium nitrate and superphosphate. (2) There was also the very marked phenomenon of slow changes in yield affecting all the plots; but (this is the important point) the plots receiving cowdung and sheep dung were markedly buffered against the steep falls which occurred in the other plots in the course of these changes and appeared most marked in the unmanured plot.

In the United Provinces an important result obtained is that well-made farm compost can replace cattle dung and that even such comparatively small additional amounts of nitrogen as 20 lb. per acre can give a 25 per cent increase in yield, while 20 lb nitrogen with 20 lb. P_2O_5 can give 80 per cent increase (in the Rohilkhand and Kumaon Circle). This is with a no-manured plot yield about 800 lb. per acre.

In Gorakhpur, with an unmanured plot yield around 2,000 lb. per acre, 17 lb. nitrogen as sulphate of ammonia, sodium nitrate or *neem*-cake gave additional yields of 6 to 8 per cent which were not significant. At Meerut, in the Western Circle, the no-manure plot gave an average yield of 3,243 lb. per acre. Nicifos at 70 seers per acre increased this only by 6 per cent. At Kalianpur in the Sarda Circle, the no-manure plot gave a yield of the order of 1,700 lb. Two hundred maunds cattle dung or 200 maunds compost per acre gave an addition of 17 per cent on no-manure. Compost made on the farm cost 5 pies per maund, the results being statistically significant. Two hundred maunds cattle dung or 200 maunds compost would contain approximately 100 lb. nitrogen. At Hardoi in the Sarda Circle, it was found that green manure with *sanai* might add about 15 per cent to wheat yields, with a no-manure plot yield of approximately 2,000 lb. per acre, whereas compost and cattle dung at 200 maunds per acre gave 8 to 12 per cent increase over a no-manure of 1,700 lb. per acre.

The results of experiments in the Central Provinces are summarized as follows:

'All the evidence goes towards showing that in the manuring of this crop under unirrigated conditions the only effectively profitable manure is cattle dung. Under these conditions the capacity of a soil for higher yields of wheat can be accepted as the outcome of accumulating fertility rather than the outcome of annual application of available nitrogen. Profitable wheat yields can be built up and maintained by steady manuring at from 3 to 4 tons per acre, adequate rotation with a leguminous crop and deeper primary tillage.

'Under irrigated conditions effective results can be secured by the use of powdered cake (240—400 lb.) applied before sowing or from 80 lb. to 100 lb. of ammonium sulphate drilled in with the seed. The possibilities of Niciphos on the heavy *rabi* soils of zones IV and VI where phosphoric acid is limited have not been as yet fully tried out.'

Mr. H. R. Stewart, Agricultural Commissioner with the Government of India, has kindly supplied the following statement regarding the manuring of

wheat in the Punjab :

Irrigated wheat : (*i*) Green manuring gives a profitable return. The increased outturn of grain was over 3 maunds or about 15 per cent in the common 100 per cent intensity rotation wheat, *toria*, cotton. With wheat following wheat annually in a 100 per cent rotation, the increase was about 6¾ maunds of grain per acre or 32 per cent.

In some tracts, the best green manuring crop is *guara* ; in others *sann*.

(*ii*) The application of nitrogenous manures is usually profitable. Thus :

(*a*) Where wheat followed wheat in a 100 per cent intensity rotation, calcium cyanimide gave a profitable return when applied either at ½, 1 or 1½ maunds per acre. The increased yields were 1½, 3 and 4½ maunds of grain respectively, representing increases of 21, 41 and 63 per cent.

(*b*) Nitrate of soda similarly gave profitable returns. When applied in similar doses, the increased yields were 2½, 3 and 5 maunds of grain per acre, representing increases of 13, 17 and 29 per cent.

(*c*) Ammonium sulphate in similar doses gave increases of 1, 3 and 4 maunds respectively per acre, representing 6, 18 and 24 per cent.

(*d*) In the rotation wheat, cotton, the increased yields were very small or negative and none of the nitrogenous manures gave profitable returns. Possibly this was because an interval of about 8 months elapsed between the harvesting of cotton and the sowing of wheat and during this period the land lay fallow and got a good deal of cultivation.

Under barani conditions : (*i*) Green manuring with *dhang* gave inconsistent results, though in a majority of cases increased yields were obtained.

(*ii*) In a 100 per cent intensity rotation, where wheat followed wheat annually, ammonium sulphate at 2¾ maunds and superphosphate at 4½ maunds per acre gave increased yields of from 2 to 3 maunds and from 1½ to 5½ maunds respectively per acre. But manuring at such high doses was not profitable.

Oil cakes : Practically no tests on manuring wheat with oil-cakes have been carried out and no information is available.

Manurial experiments from the Bombay Province show that with a non-manured plot of dry wheat giving a yield of the order of 600 lb. grain, the addition of manure supplying only 10 lb. nitrogen was of no use. In irrigated wheat at Poona, yields with farmyard manure were of the order of 850 lb., and with green manure of the order of 670 lb.

Imperial Chemical Industries in a summary of fertilizer experiments of which I have had the privilege of seeing a copy (experiments made in April 1936 to March 1938) show that with sulphate of ammonia costing Rs. 5-1-0 per maund of 80 lb. returns of the order 135 per cent on expenditure (for 20 centres throughout India) could be obtained by using from 1½ to 2 maunds (of 80 lb.).

sulphate of ammonia, the average increase in grain per acre being of the order of 2½ to 3 maunds of wheat per maund of fertilizer applied.

The results of the long series of Rothamsted experiments on wheat begun in 1843 and continued to the present time show that, as the nitrogen supply increases so does the yield, the relation at first being approximately linear, then, with higher nitrogen supply, the increments fall off (this is of course a well-known phenomenon with all fertilizers). On unmanured land the yield fell from about 20 bushels to 10 bushels after about 20 years, but it shows no signs of going lower. All the plots lost organic matter except the one receiving farmyard manure annually. The chief practical difficulty about the frequent growth of wheat was the fight against weeds, against which rapid autumn cultivation such as could be effected by a tractor proved an effective means of weed control and has in recent years been adopted with good results. The effect of one year's fallow in restoring the original productiveness for grain was marked, but the effect lasted for one year only. No ill effects such as the soil erosion visible in Western North America and other semi-arid countries have been found in England with a regular fallow-wheat rotation.

Mr. Roger Thomas informs me that in Sind, irrigated wheat gives an average yield of about 10 maunds only, much below the Punjab yields, owing to excessive rust, short winter, high humidity during maturation and indifferent farming. He also mentioned that experiments made with the use of sulphate of ammonia at 1 to 2 maunds per acre (as reported in the Imperial Chemical Industries experiments) had given good results but he did not mention whether such manuring was a regular practice on his own farm. He thought presumably the sulphate of ammonia would give the best results on the lighter and non-saline soils judging from the experience of Prof. Dastur in his experimental treatment of *tirak* in cotton (research on cotton failure).

Hill wheats: Along many hundreds of miles of the lower hills in the United Provinces and the Punjab, wheat is grown on terraced fields. Collections have been made of such wheats and grown at the Wheat and Potato Breeding Station, Simla. It is now clear that the poor stand and poor yields of these wheats is not merely due to lack of manure but that they are intrinsically degenerate. When grown side by side with other wheats on the same type of soil in the experiment station, they remain stunted and poor-yielding, while the others are much stronger and high-yielding. Moreover, if these hill wheats are heavily manured, the straw is too weak to stand additional nitrogen and lodges badly. The hill wheats are also very susceptible to rust. It is clear therefore that much improvement could be effected in the hill wheats if varieties could be evolved (1) with a stiffer straw, that would stand up to manuring, (2) that would give an intrinsically higher yield, (3) that are rust-resistant. Rust-resistance in hill wheats has also the exceedingly important effect of reducing the load of rust spores which is blown down annually on to the plains and infects the main crop of wheat in the United Provinces, the Punjab and elsewhere. Dry farming experiments in India (and also experiments in America) have shown that if the water supply is adequate, a manured plant gives a higher proportion of dry matter to the water supply; in other words a manured plant, although it uses, absolutely, more water than the unmanured on account of its greater size and evaporating surface, is more economical and efficient per unit of water than the unmanured.

Prospects: Assuming no expansion of wheat acreage and an area of 33 million acres, say 12½ million acres irrigated and 20½ million acres unirrigated, we can aim at raising the average yields per acre in the unirrigated area to 600 lb. and in the irrigated tract to 1,200 lb. giving a total of:

	In tons (approx.)
Unirrigated 600 lb. × 20½ mil. acres ..	5,500,000
Irrigated 1,200 lb. × 12½ mil. acres	6,700,000
All-India ..	12,200,000

3. *Jowar*

The millets, *jowar* and *bajra*, between them, provide the chief grain supplies for all areas outside the rice tracts and the main wheat blocks. The graphs and figures in Chapter I show the area and yield of *jowar*. The dried stalks of *jowar* (known as *kadbi*) provide the main cattle feed over a great part of India. There are, in addition, *jowar* varieties which are grown for use as green fodder.

Jowar does not grow where the rainfall is high. A rainfall of 25 to 40 inches suits it. It can be grown on a smaller rainfall if

(1) dry farming methods are used,

(2) the distribution of rain happens to be unusually good, and

(3) the crop is helped by one watering in its early stages.

It likes a fairly good soil, although, under pressure of need for food, or if the early rains are unusually favourable, it is sometimes grown in areas hardly suited for it.

Where the rainfall is less certain and the soils poorer, *jowar* is generally replaced by *bajra*. Of *jowar*, there are numberless varieties differing in all characteristics. These varieties have become adapted to, or popular in, individual districts or even talukas, and for this reason the Pulses Committee of the Imperial Council of Agricultural Research, when considering further work on millets and pulses, came to the conclusion that work on *jowar* was a matter for provincial and state effort rather than for subsidy from the centre.

In certain provinces and states, selections have been made from the existing varieties and these new races have had a certain limited vogue, but it cannot be said that there has yet been any large-scale attempt to spread improved varieties. One or two of the varieties selected for drought-resistance at the agricultural experiment station at Mohol in the Bombay Province, notably the varieties named Maldandi Nos. M47-3 and M35-1 have proved able to retain these characteristics in some other parts of India and may be regarded as an asset to areas with precarious rainfall.

Leaving aside for a moment the varieties grown entirely for fodder, the main technological possibilities of development are the increase of yields of grain and straw by (1) the use of dry farming methods for both *kharif* and *rabi* crops, (2) the utilization of finely powdered sulphur (or alternately a solution of copper sulphate) as a preventive of grain smut, (3) the use of more manure, (4) measures

against the two main insect pests—(*a*) the *jowar* borer, and (*b*) the *jowar* grasshopper.

The Bombay dry farming system of cultivation has given better yields per acre, more profit per acre and more certainty of a fair crop even in a bad rainfall year. For instance, over a period of five years at Sholapur the yield of *jowar* grain and *kadbi* averaged 2·1 maunds (169 lb.) and 122 bundles or 368 lb. *kadbi* on medium deep and deep soils cultivated under the Bombay dry farming system as compared with 1·1 maund (86 lb.) and 95 bundles or 285 lb. *kadbi* respectively on similar land cultivated according to the method in use by local cultivators. At the same centre, i.e. Sholapur, after deducting all expenditure the cash return to the cultivator on a holding of 30 acres was about Rs. 17 higher by the adoption of the Bombay dry farming system of cultivation in preference to the local cultivators' over the first five-year period. This profit would increase in later years as the main expenditure, e.g. on field *bunding*, would not certainly recur.

In Bijapur district, the advantages of the Bombay dry farming system of cultivation are more striking. The average outturn of *jowar* grain and *kadbi* grown under the Bombay dry farming system of cultivation on three soil types, i.e. limy, intermediate and deep black in equal proportion was 6·3 maunds, i.e. 505 lb. and 227 bundles or 683 lb. per acre respectively compared with 3·3 maunds, i.e. 264 lb. and 147 bundles or 443 lb. resulting from the local cultivators' methods. The increased cash profit on a holding of 30 acres, after deducting all expenditure, was Rs. 60 in favour of the Bombay dry farming system. These soils also respond better to manuring.

At Manjri, in the Poona district of the Bombay Province, the average results of seven years on an average rainfall of 23·7 in., were

	lb. per acre	
	Grain	*Straw*
Dry farming method	1,260	2,543
Cultivators methods	741	2,444

In Northern India, the crop that responds best to dry farming is *bajra*. At the Rohtak dry farming experiment station the results were: by the dry farming method 617 lb. grain, and 2,470 lb. straw; by the cultivator's method 320 lb. grain and 1,230 lb. straw (all per acre).

Manuring: The yield of *jowar* can be greatly increased by manuring. Experiments in the Central Provinces show that the no-manure plots gave 538 lb. of grain and 2,084 lb. of *kadbi* valued at the then prevailing rates at Rs. 45, whereas the manured plots gave 727 lb. of grain and 2,800 lb. of *kadbi*, valued at Rs. 60. The average cost of manure was Rs. 6-8-0, the total net profit due to manure was Rs. 9-8-0 and the net profit per ton of manure applied was Rs. 4-4-0. Bombay experiments indicate that in a rotation of *jowar* and cotton (the manure, as is the common practice in that part of India, being applied to the *jowar* crop), each ton of manure adds at least 60 lb. *jowar* grain, 150 lb. *kadbi* and 15 lb. *kapas*. In Madras (at Nandyal, rainfall 28 in.), the application of farmyard manure

(quantity not stated, probably 5 tons per acre) gave the following results in grain yields per acre, in a *jowar*-cotton rotation (lb.) :

	No-manure	*Both cotton and* jowar *manured*	*Only* jowar *manured*
Jowar yields	427	1,036	910
Cotton yields ..	146	254	234

At Hagari, with only 19 in. rainfall, the results were :

Jowar	400	532	466
Cotton	204	270	219

Taking the cost of manure into consideration, it was profitable to manure in alternate years only and to apply that manure to the *jowar*.

Rotation : *Jowar* may follow *jowar* in certain areas where it is grown only as a *rabi* crop but, generally speaking, it is grown either as part of a rotation such as *jowar*-cotton or it is grown mixed with other crops, particularly oilseeds and pulses.

After harvest : Threshing and winnowing are still usually done by primitive methods. The threshing is done by treading the heads under the feet of bullocks or under the wheels of carts or occasionally with a stone roller or a special apparatus such as the Sindhi *norag* (an arrangement of toothed wheels on a frame) drawn over the grain heads by bullocks.

Winnowing is generally done by the usual method of pouring the grain from a scoop on a windy day but hand-driven fans have been devised which are quite effective and can be used at any time and place. There is no reason why these should not become as popular as the chaff-cutter has become in the Punjab.

Kadbi : While the *kadbi* is generally cut close to the ground and utilized as fodder, there are places, e.g. Gwalior State, in which only the grain head is removed and the stalks are left standing in the field, where they may either rot or else be cut and used as fuel, the reason given being that the stalks are too hard for use as fodder. If this is so, the substitution of a variety with edible stalks would seem essential.

Vermin : At the time when the grain is ripening, it is attacked by flocks of birds and one of the cultivators' main difficulties is how to keep these off. It is generally done by a watchman on a platform who screams and flings stones, but something more effective is required.

Fungus pests : Two or three kinds of smut attack the *jowar* head, the most important one, 'grain-smut', is fortunately susceptible of simple and cheap treatment. Originally, this treatment was the soaking of the seed in a solution of copper sulphate, afterwards drying it in the sun and sowing it. A later, simpler and equally effective method is that of rubbing the seed in finely powdered sulphur—a method which had become widespread before the war after which supplies of finely powdered sulphur became non-existent. Utilization of finely powdered sulphur before the war cost only one pie per acre, completely protected the crop and might easily save damage amounting to 10 per cent of the crop or in terms of money Re. 1-4-0 (*jowar* selling at 40 lb. per rupee) on an estimated yield of 500 lb. grain per acre. These figures are all deliberately conservative.

Of insect pests, the *jowar* borer is best dealt with by digging out and burning the stubble, so destroying the rest of the insects. The *jowar* grasshopper is best dealt with in the same way as other grasshoppers by sweeping them up with large open-mouth bags in their early stages.

Fodder jowars:- Of these there are many varieties generally grown with irrigation in the hot weather. They respond markedly to manuring and are ideal crops for sewage farms. The yields of fodder that can be obtained are from 10,000 to 80,000 lb. green fodder on well or canal water and from 80,000 to 50,000 lb. on sewage. The fodder can be utilized either by feeding green or by being put into silo pits. It makes admirable silage.

Utilization of kadbi: This is most economically used when put through a chaff-cutter, a practice which is universal in the Punjab but should be spread elsewhere. Cheap chaff-cutters are made by blacksmiths in the Punjab and there is no reason why they should not be similarly made elsewhere when the necessary metal becomes once more easily available.

Storage of kadbi *against famine years*: *Kadbi* can be pressed and baled and kept as a fodder reserve. This was done on a large scale in the Southern Division of the Bombay Province and some of the material was kept for a long time and showed little deterioration. For areas which are chronically threatened by famine, the growing and storage of *jowar* stalks should be a main element in their programme, and the same should apply to the storage of jungle grass. In non-famine years a part of such a storage dump could be changed yearly, a certain amount being sold and new material replacing it. When the famine year came, there would be enough in store to carry the cattle population through at least a portion of the year pending the getting of further supplies from outside or the sending of the cattle to more favoured areas.

Jowar suffers from a small parasitic flowering plant scientifically called *Striga* and known by various Indian names such as *tahuli*, etc. The seed of this parasite does not germinate unless it comes in contact with the root of a susceptible plant. The parasite attacks certain wild grasses and also sugarcane. Once a field gets infested, it is very difficult to eradicate, as the seeds are small and remain a long time alive in the soil. The Imperial Council of Agricultural Research is financing a research of which the main object is a search for varieties resistant to *Striga* but, up to date, while there appears to be some resistance, it is not sufficient to enable the plant-breeder to get to work to select a highly resistant variety.

General outlook: There is no doubt that *jowar* will remain one of the main crops of India, outside the heavy rainfall areas. Its yield both in fodder and in grain can be greatly increased by a combination of the following measures: (1) use of good varieties and the sifting out of the small seeds, (2) rubbing the seed with powdered sulphur as a remedy against smut, (3) dry farming methods, (4) manuring, (5) a single irrigation if water can be spared, (6) the removal and burning of *jowar* stubble, (7) better protection against birds, (8) sweeping operations against *jowar* grasshoppers, and (9) better threshing and winnowing procedures; and, in utilization (1) the use of chaff-cutters, (2) pressing and baling *kadbi* against famine years, (3) making of *jowar* silage from fresh fodder, and (4) utilization of fodder *jowar* as a fodder crop on sewage farms.

Yields: It is already obvious that acre-yields differ markedly from place to place according to rainfall, additional water supply and manuring. Dry-crop grain yields may be from 100 lb. to 700 lb. while irrigated *jowar* may give

from 1,200 to 1,500 lb. (but yields of 3,000 lb. have been reported in other countries). When grown as green fodder, acre-yields of from 10,000 lb. to 30,000 lb on well or canal water and 30,000 to 50,000 on sewage can be expected. The application of the main methods of improvement suggested are capable of raising the average total annual grain production by 20 per cent.

4. *Bajra*

As already mentioned, this millet can be grown on soils which are poorer than those used for *jowar* and in a rainfall less favourable than that which *jowar* requires. With a really well-distributed rainfall, *bajra* has been known to grow on as little as 9 in. of rain, but this is phenomenal. *Bajra* offers extraordinary difficulties to the plant-breeder on account of its being normally cross-fertilized. There are areas throughout India, where particular types of *bajra* are found. Some of these are of considerable excellence, e.g. it was for a long time the practice of the Bombay Agricultural Department to recommend the growing of *bajra* seed got from Akola in the Ahmednagar district of the Bombay Province.

Even within a local type, however, there is much variation in stature of plants, size, shape and colour of grain and the character of the ear-head. We have not yet devised an effective technique for *bajra*-breeding and it seems likely that the best results may be got either from (1) mass selection, or (2) growing a mixture of previously isolated strains. A variety variously known as African *Bajri* and Jamnagar Giant was introduced from East Africa some years ago and has been grown in various parts of India. Its effect has, on the whole, been unfortunate, as it has merely crossed with the existing varieties, turning them into useless mixtures, and, where grown pure, it is by no means always better than the local in spite of its very long ear-heads.

Fungus diseases: There is a smut (not amenable to treatment by copper sulphate or sulphur) which is, on the whole, not serious, and there is another fungus disease (*Sclerospora graminicola*) which causes the ear-head to turn into a leafy mass. The rogueing of diseased plants as soon as the first symptom (a powdery appearance on the leaves) shows up is the only remedy at present known.

Bajri may suffer considerably if there are heavy rains at the time when pollination should take place. The crop is also very subject to attack by birds. Varieties with awns (bearded varieties) have some reputation as being less attractive to birds; but this is not proved, nor have awned varieties spread beyond the localities where they are normally grown. *Bajri* is seldom manured. Like *jowar*, it can be grown for fodder and in Poona has yielded as much as 10,000 lb. dry fodder per acre. This fodder is not, however, of as good quality as *jowar*. *Bajra* is, however, not susceptible to the insect that bores into *jowar* stalks.

Conclusions: *Bajra* is likely always to remain the stand-by of the areas where it is now grown. Its all-India average grain yield is of the order of 320 lb. It should be possible to push this up to 400 lb. mainly by dry farming methods in non-irrigated areas, thus giving a total of 2·5 million tons grain, a figure equalled once and surpassed twice in the last 28 years. (British India only).

5. *Maize*

Compared with rice, wheat, *jowar* and *bajra*, maize occupies a relatively smaller acreage. It is not so widely spread as any of these but is of importance in certain areas, particularly in North India. It is an important crop in Kashmir and along the entire length of the lower slopes of the Himalayas, where it is grown as a rains crop in rotation with wheat as a winter crop. Maize is quick-growing and, when grown under favourable conditions, gives a heavy

yield of foodgrain per acre up to 3,000 lb. grain per acre. It is also a valuable green fodder, being much safer to feed in its early stages than *jowar*. Where water is available, it is the best emergency fodder, producing a large amount of green feed in two months' time. Up to 20,000 lb. green fodder per acre may be expected. Like fodder *jowars*, it is also an excellent fodder crop for growing on sewage farms where much larger yields can be got.

Its dry straw has not the importance of *jowar kadbi* and, if green maize fodder has to be stored, the best way of doing so is by making it into silage. It has no important fungus pests, but suffers from the same boring insect as *jowar* and for this reason the stubble should be removed from the field and burnt.

It is peculiarly susceptible to the attacks of the larger vermin, monkeys, jackals, pigs, porcupines, squirrels and parrots.

The technological position is as follows:

Varieties: A certain amount of selection work has been done in Bihar, in the Punjab and in Kashmir. In addition, American varieties have been from time to time imported and tried in most of the maize-growing provinces It is very difficult to keep any maize variety pure, as the plants are intended by nature for cross-fertilization and the pollen blows with the wind over considerable distances. In the Punjab, it has been found necessary to keep belts of sugarcane 15 ft. wide between the maize-breeding plots in order to prevent cross-pollination. These measures are, of course, not possible in the field and the only way to ensure purity later on is to make certain that only one variety of maize is grown in a whole village and that seed is collected from areas in the centre of the varietal tract and not from the edges of it.

It cannot be said that up to date there has been any systematic effort to spread improved varieties by means of well thought out seed schemes.

Manuring: Maize responds vigorously to nitrogenous manuring and at Púsa 40 lb. of nitrogen per acre in the form of rapeseed-cake was found a suitable manure and superior to 8,000 lb. of farmyard manure per acre. Potash did not increase and, in fact, showed a tendency to depress the yield.

Rotations: There is little doubt that the maize-wheat rotation is far from being ideal (since it is cereal following cereal) and it has been shown that if preceded by gram and peas, it gives a much higher outturn than if preceded by wheat. In the North-West Frontier Province it has been recommended that maize should be rotated with berseem, the latter being sown in the standing maize crop in September and harvested in June, thus allowing time for the sowing of maize again in July.

Another possibility worth considerable experimentation is the growing of a leguminous crop along with maize. This would have a double advantage: (1) it would assist both the maize and the following crop by the nitrogen which it provides to the soil, and (2) it would prevent the erosion which so often takes place in the hill districts, in maize fields which are grown on slopes or terraces and are weeded twice in the rains, thus allowing of a considerable removal of soil by surface run-off.

In the Bombay Province, a mixture of maize and *rahar* was tried with success, the maize being first removed and the *rahar* at a much later period. The growing of maize and *rahar* is a common practice in Bihar.

Industrial uses: In recent years certain industrial firms have been much interested in the growing of maize for the production of starch and of

glucose. Last year, a certain firm asked permission to import 10 tons of two well-known South African varieties—Hickory King and Potchefstroom Pearl—reputed to have a very high starch content. This line of work is worth pursuing.

Conclusions: (1) There is need for the systematic testing of new varieties and the development of seed schemes to provide pure seed of these.

(2) Maize can be better manured if composting is pushed (see Section III under Manuring).

(3) The growing of a leguminous crop either along with or in rotation with maize, needs study and popularization if found economic and soil-conserving.

The average all-India yield could be forced up from the present level of about 800 lb. per acre to a level of about 1,000 lb. per acre. On a 5·5 million acreage, this would be 245,500 tons, a figure that has been nearly reached three times and surpassed once in the last 23 years (British India only). The United States of America average acre yield was 1,825 lb. and that of the Argentine 1,545 lb., while that of China is 840 lb. (*International Year Book of Statistics*, Rome, 1923. Statistics for 1909—13).

In America, there is now a very large acreage under what is known as hybrid maize. In 1938, the area under hybrid maize was 17 million acres. Hybrid maize is obtained from the first generation seed got from the large-scale crossing of two varieties. The hybrid seed has to be produced anew every year and therefore requires very large areas for seed production alone and the process of hybridization demands a highly skilled staff and land a long way off from any other maize cultivation. First-generation hybrids often show much more vigour than either parent. It is this vigour which is exploited in hybrid maize, showing itself in increased yields over the parents, of the order of 10 to 20 per cent. Increases up to 35 per cent have been obtained under conditions of commercial production. At the Imperial Agricultural Research Institute, on a small-scale test five years ago pure strains were crossed and showed conspicuous hybrid vigour in the next generation. No serious attempt has been made to produce hybrid seed on a large scale for lack of money, staff and land.

6. Gram

Of all the Indian pulses, gram is the most important and most widespread. It grows on all kinds of soils and is grown both as a single crop and mixed with others, e.g. wheat. It is generally a *rabi* crop. In certain parts of India, it is grown after rice and in other places after maize, *bajra* or *jowar*.

Yields vary according to the soil and climate and whether irrigation is or is not given. The yields range from 350 lb. per acre in the Bombay Province (Central Division) to 500 lb. (Gujerat Division) and 800 to 1,200 lb. in the Punjab. It is valuable as a rotation crop and seems to have a definitely beneficial influence on the following crop. There was a notable example of this in a certain rice research station (in Bihar) when the good effect of a gram crop in the rotation was so marked that it seriously interfered with the results of the manurial experiments laid out on the following rice crop.

The technological position is as follows:

Varieties: Gram breeding has been done at the Imperial Agricultural Research Institute and in the Punjab, Bihar, Bombay and Madras. Four of the I. A. R. I. strains are under wide distribution, the most successful of these being IP58. In the Punjab, F8 (a variety of French-origin obtained from the

United States of America) has proved blight-resistant and is being multiplied for use in blight-stricken areas. An attempt is also being made to increase its yielding power. For areas not affected with blight, the Punjab Department recommends its variety Pb 7 which is a high yielder. The use of improved varieties ought to give increased yields up to 800 lb. per acre.

Diseases: In addition to blight (due to the fungus *Mycosphaerella pinodes*) there is also a serious disease wilt (caused by *Fusarium*) which is particularly virulent in the provinces of Delhi, the Punjab, the United Provinces and the Central Provinces. The plant-breeders are endeavouring to get varieties resistant also to this disease, but so far there has not been any marked success. There is a caterpillar (*Heliothis armigera*) which bores into the pods and does considerable damage. Against this also no effective remedy has been found.

In store this pulse, like others, is apt to suffer from boring beetles (*Bruchus chinensis*, commonly called *dhora*). The remedy against this is treatment with carbon bisulphide.

The crop is not generally manured.

Prospects: Given varieties really resistant to wilt and blight and with good yielding qualities as well, the yield of gram in the Punjab and North-West Frontier Province should increase considerably and the general all-India average acre yield be raised from the 500 lb. level to the 600 lb. level, giving on a 12 million acre area a yield of 320,000 tons, if it is desired to keep the acreage at this low level. On a 15 million acre area, this acre yield would give 4 million tons, a figure surpassed five times between 1917-18 and 1924-25. (British India only).

7. *Pulses*

India has a great range of pulse crops, important from the points of view of agriculture and of nutrition. They are an invaluable phase in many rotations, helping to keep up the fertility of the soil, which purpose they also perform when grown (as they often are) as mixed crops, particularly with millets, the millet ripening and being harvested first. In the realm of nutrition they are sources of protein, particularly necessary in a country where the bulk of the population is vegetarian. They are also important from the point of view of animal nutrition, to which they contribute in a variety of ways, e.g. by their seeds, by their hulls, and by the green parts of the plant.

The only pulse crop dealt with so far in this note has been gram. The following is a list of the others:

Guwar or *guwara*	*Cyamopsis psoralioides.*
Lentil or *masur*	*Lens esculenta.*
Kesari, Lang or *Lakh*	*Lathyrus sativus.*
Peas, *Mattar* or *Vatana* ..	*Pisum sativum.*
Sword Bean, *Abai* or *Bara Sem* ..	*Canavalia ensiformis.*
Lima Bean	*Phaseolus lunatus.*
French or Kidney Bean (*Vilaati Sem*)	*Phaseolus vulgaris.*
Moth or *Math*	*Phaseolus aconitifolius.*
Green gram, *Mung* or *Mug* ..	*Phaseolus mungo.*
Black gram, *Udid, Urid* or *Mash* ..	*Phaseolus radiatus.*
Cowpeas, *Lobia* or *Ghavali* ..	*Vigna catjang.*
Ghevda or *val*	*Dolichos Lab-Lab.*
Horsegram or *Kulthi*	*Dolichos biflorus.*
Soybean	*Glycine soja.*
Pigeon pea, *tur, rahar*	*Cajanus indicus.*

Of all these, *arhar* or *rahar* is the most important. Of this crop there are several types, some of which are small-sized and of comparatively short season, ripening in five to six months. Others found in the Gangetic alluvium are much bigger and mature in from eight to nine months. Both types are often grown mixed with other crops. The crop is drought-resisting, partly on account of its deep-root system. It is a remarkable restorative rotation crop since it is not only one which (1) causes deep soil aeration by its roots, (2) adds nitrogen by its root nodule bacteria, but also (3) naturally manures the soil with a heavy dressing of fallen leaves. It is somewhat susceptible to frost and there is a caterpillar which attacks the pod. But its main enemy is a soil fungus *Fusarium udum*, producing wilt. Considerable work has been done at the Imperial Agricultural Research Institute and elsewhere in an attempt to get wilt-resistant varieties. In the Central Provinces strain No. 88 appears to be wilt-resistant. Some of the Bengal strains appear also to have this character. Variety C15 and T80 produced at Pusa are also promising.

The yield per acre varies considerably according to the mixture adopted. When sown alone, it may yield up to 800 lb. per acre and in mixture 200 lb. or 300 lb. per acre.

Sir John Russell, in his Report, recommended that more attention should be given to the pulses. As a result, the Pulses Sub-Committee of the Imperial Council of Agricultural Research, in June 1940, considered the question of coordinated research on pulses. It was decided that the Agricultural Commissioner (Dr. Burns) should, on the basis of papers that had been sent in from provinces and states, draw up an outline of future work on pulses throughout India and that statistics of the area under each of the pulses in the different provinces and states and their production should be obtained wherever possible through the Directors of Agriculture. Dr. Burns accordingly drew up such an outline and it was considered at a later meeting of the Pulses Committee and the Advisory Board. As a result of this meeting, it was decided to invite provinces and states to send up pulse schemes on a more or less uniform plan. Up to date, such schemes are now in action in the following provinces and states: Bombay, Sind, Mysore and Baroda. Schemes have also been sanctioned for the following provinces and states and will be put into action shortly: Madras, the United Provinces, the Central Provinces, Bihar, Bengal, the North-West Frontier Province, Hyderabad State, Orissa. A scheme on soybean is also sanctioned for the Punjab.

The aims of all the schemes are more or less the same and include the collection of all available types, the isolation of varieties or strains suited to different tracts, the growing of pulses in mixture and the study of the influence of the pulse on the yield of the cereal and on the soil, the value of certain pulses as green manuring and as fodder, the protein content, and also the following important trade objectives, viz. that the varieties evolved should have suitable grain size, attractive colour, good keeping quality and that the produce should be uniform. Since this work has just been started, results applicable in practice will not be available for some years. But enough is known of the agricultural value and performance of pulse crops to enable Agricultural Departments to advise on immediate lines of action connected with the pulses. One such important use is to sow them immediately after rice to utilize the remaining soil moisture. This has already been mentioned as a practice with gram. In the Konkan, *val* follows rice and *mung* is similarly used in the Dharwar, Colaba and Kanara districts of the Bombay Province after rice.

Guar or *Guara* (*Cyamopsis psoralioides*) is a pulse of great importance both as a vegetable for human consumption and for the feeding of cattle and horses. In the Punjab, an ordinary pulse crop yields about 260 maunds of green fodder per acre and grown as a pulse there it yields about 6 maunds of seed. It has proved a useful crop in rotations at the Dry Farming Research Station, Rohtak.

India is so rich in pulses (not only in the number of species but also in the varieties and types within these species) that there is scope for further imaginative experimenting with these in different rotations and mixtures. In any Grow More Food campaign, they can be confidently pushed, since (as has already been mentioned) they are the main sources of protein in a vegetarian diet.

8. *Linseed*

This important oilseed is grown in a variety of places in India, sometimes as a pure crop, sometimes mixed with others. It requires deep moisture-retaining soil, and, in certain of the black soil areas, where *durum* wheats are grown in the Indian Peninsula, may compete with wheat for such soil, the preference for one or other crop depending on the demand and price. In other parts of the same area it may be replaced by safflower, for which there is a local preference. In Northern India, linseed is grown chiefly in the submontane districts and does best on heavy loamy soil. In all places it is apt to be damaged by rust for which there is as yet no satisfactory remedy. The Imperial Economic Botanist and others have been endeavouring to get rust-resistant varieties. The degree of their success is as follows :

At the Imperial Agricultural Research Institute a number of strains have been evolved by hybridization between rust-resistant foreign varieties and Indian types. Several of these are highly resistant and a few even immune to rust. They also possess other economically important characters such as good yield, good tillering, good habit and light-coloured seeds (fawn and yellow). These are being tested for their rust resistance under conditions of artificial infection to confirm observations in the field and are also being distributed for trial in the different linseed-growing tracts. It is expected that within two or three years it should be possible to recommend to cultivators and the Agricultural Departments of provinces and states two or three strains combining rust-resistance with other economically important characters.

The United Provinces Department of Agriculture has also evolved one or two rust-resistant strains, but their cultivation does not seem to have spread to other provinces and states.

Yields : In the Deccan, yields are of the order of 500 lb., often less, and about the same in the Punjab. Linseed-breeding has been done at the Imperial Agricultural Research Institute, in the Central Provinces and Bengal (under schemes subsidized by the Imperial Council of Agricultural Research), in Bihar and the Punjab and in the Bombay Province in a scheme financed by the Sir Sasson David Fund. It does not appear that any single improved variety is yet in mass production. There appear to be no manurial experiments of any importance. In the research subsidized by the Imperial Council of Agricultural Research in the Central Provinces, Dr. Richaria, then Economic Botanist, investigated the production of fibre from the stems of the linseed plant, and produced material which he considered promising both for use as a fibre and for cottonization (i.e. treatment by chemicals to make it spin in the same way as cotton).

It appears, however, that cottonization is not likely to be an economical process, but there is no reason why the untreated fibre should not be a useful source for twine and light cordage. This is worth following up, particularly at the present time when commercial fibres of all kinds for cordage are in short supply.

In the Botanical Section of the Imperial Agricultural Research Institute investigations are on hand which aim at improving the fibre quality of linseeds by the hybridization of linseed with flax. Some of the more promising strains thus obtained are being tested both for their fibre and other qualities. These investigations when completed, it is hoped, will enable cultivators and industrialists to make use of linseed straw which at present is hardly made use of at all.

9. *Brassica* oilseeds

These include the following :

Indian colza (*Sarson*)	*Brassica campestris.*
Indian mustard (*Raya*)	*Brassica juncea.*
Indian rapeseed (*Toria*)	*Brassica napus.*
Rocket (*Taramira*)	*Eruca sativa* (a Brassica substitute).

Of these, rapeseed (*toria*) is by far the most important. Half the area is in the United Provinces, and the Punjab is the next most important *toria*-producing province. The Imperial Council of Agricultural Research has subsidized for several years research on all these oilseeds in the Punjab. This work has been carried on there by Khan Sahib Ch. Ali Mohammad, and the following are the main results up to date.

Production of new varieties : (1) Different group breeding methods for the improvement of *toria*, brown *sarson* and *taramira*, which are all self-sterile, being extensively cross-pollinated in nature by insects, chiefly bees, have been tried with considerable success. *Toria* selection A, a strain evolved by continuous mass selection and officially approved for large-scale distribution has become very popular.

The aid of bees has been successfully utilized for producing nucleus seed in sufficient quantities by rearing bees (*Apis indica*) inside big cages containing desirable plants required to be intercrossed.

Experiments conducted on the farms as well as in zamindars' fields to investigate the possibilities of utilizing hive-bred bees as pollinating agents and thereby of increasing *toria* yields, *i.e.*, by rearing such bees in *toria* fields, resulted in an average increase of about 10 per cent in pod-setting. The method appears to be an economic proposition. Further trials are, however, necessary to confirm these results.

Investigations into the rate of degeneration of the cropping capacity of *toria*, if mass selection were discontinued for a time, has shown that with the cessation of selection even for two consecutive years, though there is a tendency towards deterioration setting in, the yields are not significantly affected.

(2) The application of pure-line breeding methods to yellow *sarson* and *raya*, which are self-fertile, has resulted in the isolation of a number of pure types, the most promising ones from amongst which are under field trials. In the trials with types suited for *rabi* sowings, *raya* L18 has proved to be the highest yielder and has deservingly become very popular both for irrigated and unirrigated conditions and its seed is now in great demand. Averaging 100 tests carried on between 1937 and 1941, L18 yielded 1,857 lb. per acre against 1,002 lb. of the local

sarson. Another *raya* type, viz. L9, appears to be still more promising but requires further testing. Among the types tested against *toria* in early or *zaid kharif* (extra summer) sowings, *raya* L16 has given the best results, and is considered likely to replace *toria* in a zamindari practice. It outyields even the improved *toria* A by 10 to 25 per cent. Below are two 1940-41 results :

(1) at Montgomery	
Toria A	910 lb.
L16	1,157 lb.
(2) at Lyallpur	
Toria A .. .	628 lb.
L16	690 lb.

(3) Various inter-varietal and inter-specific crosses have been studied from which a number of plants and strains combining desirable characters have been selected for further trials. Of these, a cross between *raya* and *toria*, made with the object of evolving new forms of economic value by crossing two species of the genus Brassica, is likely to yield very valuable results.

(4) Chemical investigations into the oil content of various types and hybrids under trial have greatly facilitated the selection of desirable types.

Studies into the factors affecting oil formation in the developing seeds, and on the effect of different seed storing methods, on changes in oil content, etc. of the seeds are in progress.

Work has also been carried out on various aspects of these plants by the Imperial Economic Botanist, New Delhi, mainly on genetic problems.

Vernalization : At Almora, Mr. Boshi Sen, in a research financed by the Imperial Council of Agricultural Research, has shown that it is possible to obtain a considerable increase in earliness as a result of the vernalization of mustard seed. His results, however, have not yet been tried out on a large scale.

Manuring : It has been definitely ascertained that if in the usual rotation in which *toria* follows wheat, the land is green-manured with *guara* (*Cyamopsis psoralioides*) before sowing wheat, the yield of *toria* increases considerably due to the residual effect of the green manure. As a result of the trials conducted in the Punjab, 40 lb. of nitrogen applied in the form of ammonium sulphate, half at sowing and half at flowering, produce the highest increase in yield, the average acre-yield (for three years) under such manuring being 1,026 lb. against 700 lb. in the non-manured area. The application of fertilizer to *toria* is quite profitable under normal conditions, but, with the abnormal rise in the price of ammonium sulphate due to war conditions, it may not be an economic proposition. Any yield increase, however, tends to depress oil content and a balance has to be struck by local experimentation.

Diseases and pests : The Brassica crops usually are not very subject to fungus diseases, but some forms of these crops, particularly *toria* and *sarson* are often seriously attacked by *Alternaria Brassicae* which affects leaves, stems and pods and reduces the yield and quality of the produce to a considerable extent. Of the insects, besides *Aphis* (green fly) which sucks the juice from leaves, stem and shoots, other insects such as painted bug and white butterfly also do some damage. *Rayas* (Indian mustards) in general withstand the effect of the fungus and insect pests to a considerable extent. Investigations on the control measures of diseases and insect pests of Brassica and other oilseed crops

have recently been taken in hand in different provinces under a coordinated scheme financed by the Imperial Council of Agricultural R search.

Prospects: The use of improved varieties alone will give increases of the order of 15 per cent provided there is a comprehensive seed supply arrangement. Manuring could put on another 10 per cent (total 25 per cent).

10. Groundnut

While groundnut is not a new crop in India (it was probably introduced into India about the 16th century), its rapid development is of comparatively recent date. There was gradual expansion up to about two million acres at the outbreak of the last war, a fall to about half that area at the end of the war and, after 1920, a very rapid expansion, so that the acreage is now about 80 times what it was 50 years ago and four times what it was 30 years ago.

Groundnut has proved suitable to many different areas in India. It is comparatively hardy and (since the *tikka* disease was overcome) not much subject to diseases or pests. It is a valuable money crop and it is useful in a rotation. The kernels are used directly for eating and for the extraction of oil, after which extraction there remains a cake with a high nitrogen content, valuable either for feeding livestock or as a manure. In recent years, the use of the oil for the manufacture of Vanaspati (a ghee substitute) has increased the demand for that oil and the shortage of artificial manures has increased the demand for and the price of the cake. There is no doubt therefore that groundnut is firmly established as one of India's main cash crops. The following are the technological possibilities:

Varieties: While the trade has a number of varieties under different names, these fall more or less into four big classes: (*i*) *Coromandel* (the present-day name of imported Mozambique seed sometimes called Mauritius), (*ii*) *Bold* (originally Big Japanese), (*iii*) *Peanut*: (Originally Spanish Peanut), and (*iv*) Red Natal (originated from Small Japanese variety.)

These have taken hold in different areas to which they are suited. The one that seems somewhat undesirable is the Red Natal (sometimes called Lalboria), which produces a dark-coloured oil due to the deep red skin of the kernels.

In Mysore and Madras, there has been a certain amount of plant-breeding applied to the groundnut crop. Dr Badami in Mysore made a very large collection and selected a variety known as HG1 which has been introduced into Nellore, Trichinopoly and Tanjore. Dr. J. S. Patel, when Oilseeds Specialist in Madras, made several selections and the work has been carried on by his successor in a scheme financed by the Imperial Council of Agricultural Research. Dr. Patel's variety, AH25, has proved a high yielder, giving 1,750 lb. per acre. Of 260 field trials conducted with this variety, the general result was that it gave 20 per cent more than the local. Various selections have since been made, which show significant increases over AH25. For example, in 1940-41, the new varieties AH685 and AH698 tried at a number of centres in Salem and North Arcot recorded yields 50 per cent above the local. The variety 477 in Hyderabad gave 49 per cent above the local and in Mysore 32 per cent above the local. Variety 186 at Nandyal in Madras in trials between 1938-39 and 1940-41 averaged 1,003 lb. per acre against 817 of the local. In Bombay varieties AH 113

and 186 averaged 14 per cent above the local. It is therefore plain that new varieties produced in Madras are capable of giving something of the order of at least 20 per cent over the existing varieties and are suitable for many parts of India. In addition, most of the improved strains not only gave high yields of nuts in the shell but also a higher percentage of nut to shell and a high percentage of oil in the kernels. Of the varieties tested for 1938-39 to 1940-41 and mentioned in the reports on the scheme of research on groundnuts in the Madras Province, the shelling percentage is 78 against 71 per cent as the average of commercial samples and the oil percentage 51·2 as against 50·8, the average of commercial samples. These are very considerable improvements indeed and, if retained under large-scale cultivation, should make a big difference both to groundnut agriculture and to the industries based on it.

Manuring : Groundnut, like other leguminous plants, is able to manufacture much of its own nitrogen by means of the bacteria on its roots. Nitrogenous manuring has not therefore so far given significant results. In soils where there is a deficiency of phosphates or potash, the application of these elements increases yield, but up to date has not proved economical.

Cultivation methods : It is necessary by local experiments to determine the best spacing to get the maximum yield in the local conditions of soil and rainfall. Correct spacings may increase the yield by as much as 25 per cent over a spacing that is too wide.

The operation that needs most attention is harvesting, both to increase the efficiency and the speed of the work. In certain areas promising results have been obtained with simple types of bullock-drawn hoe or plough, particularly with weighted hoes, but the matter needs further attention.

Yield : The following table adapted from the *International Year Book of Agricultural Statistics*, 1938-39, may be taken as fairly representative :

	lb. per acre		
	1935	*1936*	*1937*
India	954	902	883
Senegal	723	785	741
Union of South Africa ..	446	491	..
United States of America ..	758	758	803
China	1,499	1,668	..
Argentina	1,138	625	669
Spain	1,072	..	..
Italy	..	1,758	1,695
Mauritius	2,230	2,230	2,230

Along with this should be seen the average for British India given in table 12 in Chapter I of this note.

Agricultural advantages and disadvantages of groundnut : (1) Generally speaking, it is useful in a rotation for two reasons : (*a*) Like other leguminous plants, it tends to increase nitrogen supply in the soil, (*b*) The thorough stirring of the soil necessary at harvesting breaks up and aerates the soil more than with most other crops. This has, however, one disadvantage, that in heavy rainfall areas, where the land is sloping, it tends to increase erosion.

(2) The above-ground portion of the groundnut plant (stalks and leaves) is a valuable fodder for livestock.

(3) Groundnut, however, is much liked by wild pigs, which come to dig up the nuts. Even crows have learnt how to dig out these nuts. Field rats also feed on the nuts. The crop, therefore, is one not easy to protect from certain vermin.

Modern oil technology is such that it is often possible to substitute one oil for another in connection with the same manufacturing processes. Germany, for example, which used to be a large taker of groundnut, deliberately switched over to soybean as a source of oil, for political and industrial reasons, several years before the war. It is important, therefore, so far as international trade is concerned, to keep the groundnut supply of good quality and at a competitive price.

Prospects : It is not too much to say that the annual acre-yield could be pushed up to 1,000 lb. per acre and the oil content by 1 per cent. This would give 3,120,000 tons nuts on 7 millions acres.

This same production in the years 1933-37 averaged 2,822,000 tons only.

11. Castor

There is little doubt that castor-seed now occupies a significant place in the world's supply and trade of oilseeds. The oil from the seed, besides being used for medicinal purposes, finds use as a lubricant in the textile industry (as Turkey Red Oil), and for preservation of leather. In India, the oil is also used as an illuminant. The cheaper mineral oils tended to oust castor oil, up till the war, from the field of lubricants and illuminants, but the increasing use of castor oil in aviation and the shortage of supplies of mineral oils in India brought the oil into prominence again.

India, at one time, was the world's premier castor-seed producing country but, with the rapid progress which this crop has made in Brazil, India now occupies the second place in the world's production of castor-seed. The production of castor-seed in Brazil is more than 1½ times the Indian crop. In India, the Hyderabad State and Madras account for the bulk of production.

The castor plant is hardy and grows in the most diverse conditions of soil and climate. It thrives lustily in Sind and it grows well in the Hyderabad and Mysore States, in the Madras Province as also in the United Provinces. After the disastrous floods in Gujrat (Bombay Province) in 1927, it was about the only crop that could be grown on land immediately the floods had subsided. It is often grown either mixed with other crops or as a border to other crops, solid fields of it being found mainly in the Hyderabad State. While it cannot be said that there are many named varieties, there is a multitude of forms differing from one another in height, in colour of stem, leaf and capsule, in the amount of wax (bloom) on the stem, in earliness or lateness, in size, in colour of the seed-coat and in oil percentage. Plants also differ in the proportion of male to female flowers carried on the flowering shoots. For commercial purposes, the two main varieties are the small and bold seeds. The small seeds generally contain more oil than bold seeds.

All these variations have given scope to the plant-breeder, and while a certain amount of selection work had been done in the Bombay Province, Baroda, the United Provinces and Mysore, the main work in recent years has been

done in the Hyderabad State in a research jointly financed by that State and the Imperial Council of Agricultural Research. In this, the fifth year of the scheme, four promising strains named 626, 809, M172 and W115 have become available for field-scale yield trials. The oil-content and commercial value of these new strains have been appraised by a large oil-pressing firm in Bombay and by leading export firms. M172 was pronounced by the trade to have a much higher oil-content (50 to 52 per cent) than either the local Hyderabad variety (47 per cent. oil-content) or the usually exported Indian seed (45 per cent oil-content). This strain has also been found to yield 25 to 30 per cent more seed per acre. It has been renamed HS1 and a scheme for the extensions of its seed-distribution has been prepared. The seed of this strain has already been spread over some 4,000 acres in Hyderabad State. Large-scale oil-expression tests by the local methods have also been run in the two largest trading centres for castor seed in Hyderabad State over three consecutive seasons. HS1 was found to give 11 per cent more oil than the best quality local seed in these trials. In addition to its other qualities, HS1 has got a spineless capsule which should make picking much more easy and a green stem colour that makes it easy to weed out off-type plants. The selected varieties have also got characteristics of seed, size and seed colour which suit the trade. Seeds that are too large or too small do not fit the machinery used for expelling the oil.

Some of these strains have been tried out in other provinces and states as well, for comparison with improved strains and the local varieties. At Nagpur, strains 809 and W115 equalled in performance the two improved strains of the Central Provinces, EB31 and EB16. At Saugar (Central Provinces), W115 was equal to EB31, at Kalyanpur (United Provinces) W115 and 809 gave significantly greater yields than the other six varieties tested. At Lyallpur (Punjab) the three Hyderabad strains showed 2 to 13 per cent better in yield than the local and 2 per cent better than the variety Cawnpore 23. So far as varieties are concerned, it is largely a matter of multiplying seed. This is rather a slow business as compared with other crops since the plants are widely spaced and do not give per plant the same very large number of seeds that are got from cereals. Moreover, the danger of crossing is great and this involves (1) the bagging of many plants in the plant-breeders' plots, (2) the growing of the second stage seed in fields distant from any other castor field and (3) rogueing of plants at all stages.

Manuring: So far as manuring is concerned, there is little in the way of positive results. Manuring with castor-cake at the rate of 30 lb. nitrogen, while it gives increase, has not so far been remunerative, at the prevailing prices of castor-seed. The same quantity of nitrogen applied as farmyard manure is, however, profitable. The manurial work is being pursued.

Pests and diseases: Castor suffers from a rust which it has not so far been worth while attempting to control. The Imperial Council of Agricultural Research and the Hyderabad State are now jointly financing a scheme of research on castor rust. There is a caterpillar which can also be a nuisance but which, again, it has not so far been worth while attempting to control, as the expense of labour is not compensated by plants saved.

The place that castor is to play in post-war Indian agriculture depends on (1) what part castor oil is to play in the post-war world, and, (2) whether there is going to be further extensions of castor cultivation in certain other countries which have taken up cultivation, e.g. Brazil, U. S. S. R., Manchuria and the Argentine.

It should be mentioned that castor cake is a valuable manure and much used for manuring sugarcane and tea. Since it contains a poisonous principle (ricin), it is not suitable for use as a feeding cake. Its nitrogen percentage is also lower than that of groundnut-cake. But it has a considerable vogue as a manure, being much liked by the sugarcane cultivators of the Bombay-Deccan and has the reputation (scientifically not tested) of keeping off white ants.

In 1942-43, in the whole of India, there were under castor 1,352,000 acres producing 147,100 tons. Of this acreage 728,000 was in Hyderabad State with a production of 83,000 tons and 273,000 acres were in Madras Province with 25,000 tons.

By the use of improved varieties the average acre-yields could be raised by 10 per cent and the oil-content by 3 per cent.

12. Sugarcane

(*a*) Sugarcane is grown throughout India. There are two distinct belts:

(*a*) The Indo-Gangetic alluvium in the North, which previously grew mostly thin canes, and

(*b*) The Peninsular belt in the South, where thick canes are the chief types. The Peninsula is warm in the winter months and there is no severe check to the crop. Sugarcane can be planted practically throughout the year. In the Northern belt, though the soil is perhaps on the whole more fertile, the crop is subject to extreme heat and cold. It is a curious fact, into the history of which we need not now enter, that the growing of cane for the white-sugar industry should have its main centre in the Northern belt.

The great stimulus to the development of sugarcane cultivation came with the imposition of the sugar tariff in 1932. Here, again, it is unnecessary to go into history. An appreciation of the present position so far as technological development is concerned will suffice.

Varieties: The breeding of sugarcane for Indian (and particularly North-Indian) conditions was begun by the late Dr. Barber at Coimbatore in 1913 and was carried on by Sir T. S. Venkatraman uptil last year and is now in charge of Mr. N. L. Dutt. From Coimbatore there has poured out a stream of new varieties, the so-called Co canes, from which suitable types have now been found for every area in India. In addition, there has been breeding in Mysore of the so-called HM canes (HM=Hebbal-Mysore) and there is now breeding being done at Karnal, Shahjahanpur, Jorhat and elsewhere. The main work, however, continues to be at Coimbatore. Much of the work of the chain of sugarcane stations financed by the Imperial Council of Agricultural Research has been the testing of varieties and, although this work continues, a certain degree of stability has been reached as regards the types most suitable for different areas and being exploited therefor. Over 75 per cent of the total area under sugarcane is now covered by improved varieties. In this direction, therefore, the scope for technological development is not so great as in some other crops. Progress is possible in (1) the spread of improved canes over the whole sugarcane area, (2) the selection of varieties resistant to pests and diseases, (3) the substitution of varieties that are still better in performance than the good ones now in use, particularly the selection of such as are more efficient in the use of manure, i.e. which, for a given addition of mineral nutrients, give a larger amount of sugar.

Manuring: While there has been a large amount of experimentation, here again there has not been one consistent theory or plan behind the experiments and in many places the nature and design of the experiments have been such

that there are large gaps in the available information. The following are some examples :

(1) There has been no systematic investigation of the relative values of farmyard manure, green manuring and compost.

(2) Where these have been experimented with, there is often no record of their nitrogen content or of the availability of that nitrogen.

(3) There has been no systematic long-range experimentation to determine the effect of continued application of organic and inorganic fertilizers, separately and in combination, on the fertility status of the soil.

(4) There has been little systematic study of the relative values of different oil-cakes as fertilizers.

(5) Soil analysis has not gone hand in hand with field experimentation

The following facts, however, are unquestionable :

(1) Nitrogenous manuring every year is a necessity for sugarcane throughout India.

(2) Phosphatic manuring is necessary in a few places.

(3) Potassium manuring is required in still fewer places. Once applied, phosphatic and potassic manures continue to have an effect for a number of years.

There has been much experimentation regarding the optimum dose of nitrogen per acre, the form in which the nitrogen should be given and the times of its application. It appears that the optimum dosage is not the same throughout India and that it is lower in the Indo-Gangetic alluvium than in the Peninsula. The exact reasons for this are not clear, but may be (1) the difference in climate, (2) the difference in soil, (3) the difference in varieties of cane grown. In most sugarcane-growing provinces and states, a stage has now been reached when an optimum dose can be recommended with confidence and the main question is how most economically to apply that dose.

This is a question of what fertilizers are available and at what prices. Farmyard manure when available and when of good quality has excellent effects but of the nitrogen in it about 50 per cent is not easily available to the plant, so that while it improves the physical conditions of the soil (as regards tilth and water-holding capacity) it does not feed the plant with the same efficiency as some other sources of nitrogen.

In certain areas (e.g. the sugarcane areas of the Bombay-Deccan canals, where farmyard manure is scarce and dear), green manuring with sunn-hemp has been pushed and has been exceedingly effective. The only drawback is the loss of a *kharif* crop but certain experiments made in the Bombay-Deccan appear to indicate that this loss is more than made up by the increase of the cane crop due to the green manuring.

It is, however, possible to take a *kharif* crop without detriment to the succeeding cane crop, provided the *kharif* crop itself or the cane crop that succeeds it, gets a basal dressing of compost or farmyard manure to prevent soil exhaustion. The *kharif* crop might be either short-season cotton or a food crop, and it is plain that if maximum production from the soil is wanted, a *kharif* crop should be taken. This means a demand for still more nitrogenous manure, i.e. for both the *kharif* crop and the following sugarcane crop.

Of the other organic manures, by far the best results have been obtained from the use of oil-cakes. These vary considerably in their nitrogen content, i.e. from the castor-cake with 4 to 5 per cent nitrogen to groundnut which may contain as much as 8·5 per cent nitrogen. Oil-cakes, in addition to improving tilth, have the advantage of being quick-acting, the nitrogen being readily and quickly available. The extent of their utilization depends on their price and this to a certain extent depends on their availability, i.e. whether they are produced in the neighbourhood or have to be brought from long distances.

The universal experience throughout India is that organic manures and particularly so-called basal manures like farmyard manure and green manure which have a small percentage of nitrogen, have to be reinforced with quick-acting fertilizers, of which oil-cakes and sulphate of ammonia are the only ones now in the picture. A mixture of sulphate of ammonia and oil-cakes to supply from 60 to 225N lb. per acre is necessary to secure a normal crop according to the area in which the cane is grown.

Other manures: There has been a certain amount of experimentation with molasses as a manure. In the United Provinces and Bihar, manuring with molasses, if applied at least two months before planting, has given beneficial effects. In the Punjab, there was no favourable response, while in Southern India molasses appears to have a low fertilizing value. Experimental work at Padegaon (Bombay Province) has, however, shown that the manurial value of molasses can be greatly increased by mixing with it either bagasse ash or lime, just sufficient to neutralize its acidity. So far as the United Provinces and Bihar are concerned, except for factory farms, where it can be easily transported into the fields if there is no better market for it, it does not seem to have much future as a manure. The Imperial Institute of Sugar Technology has been experimenting with methods to produce a solid manure from molasses either with or without the addition of press mud, but the manufacture of such solid manure has not yet been tried out on a big scale.

Compost: Where this has been made and tried, it has given results similar to those obtained from farmyard manure, and there is every reason for pushing on with the development of economic means of making, transporting and applying compost, particularly from cane-trash.

Water: Associated with manure is the question of the application of water. Experiments on the optimum amounts to be applied are still few and far between and the means for applying such results in practice is still to seek in many places, although in the Bombay-Deccan the sugarcane factory estates are supplied by measurement and the irrigation is based on the results obtained at the Padegaon sugarcane research station. The central fact is that higher manuring requires higher watering if the full value of the higher manuring is to be obtained.

Yields: The *average* per acre yield of sugarcane throughout India is still low. Up to 1901-02 it was only 8 tons per acre. In recent years, it may be regarded as about 15 tons per acre. In any well-run farm, yields of 30 tons cane per acre are common. In the Bombay-Deccan yields of 40 and 50 tons have been obtained without difficulty from 'plant' cane, i.e. cane planted in January and getting one monsoon, while yields of 70 to 80 tons have been obtained from *adsali* cane, i.e. cane planted in June and getting the effect of two monsoons. In 1934, the Maharashtra Chamber of Commerce held a competition with the object of giving prizes for yields of 100 tons per acre. Over 100 tons were actually obtained on three of the competing farms and another had a yield of 98 tons. These results were obtained by very high manuring and liberal watering. The

actual extreme yield of sugarcane which it is believed possible to obtain anywhere in the world is theoretically 192 tons, and this has been approached in Hawaii with a yield of 185 tons.

With these figures before us, there is no doubt that the average yield of cane in India can be forced much higher than it is at present, particularly in areas where the climate is suitable. The following may be regarded as acre-yields of cane which it should not be difficult to obtain in the following provinces :

	Tons
North-West Frontier Province	30 to 35
Punjab	40 to 45
United Provinces	27 to 35
Bihar	25 to 35
Bengal	35 to 40
Madras	45 to 55
Bombay, Mysore	45 to 55—for plant cane 70 to 80—for *adsali*

Pests and diseases : The most serious fungus pest is undoubtedly red rot, and the epidemic of this disease which occurred three years ago shows what can happen if there is any slackening of watchfulness. Dr. Padwick, Imperial Mycologist, has recently cleared up some further obscure points regarding the spread of this disease and it is clear that if the following measures are taken it can be kept under control: (1) elimination of varieties that are highly susceptible, (2) utilization only of uninfected sets, and (3) field hygiene, such as rogueing of diseased clumps and of diseased trash.

Of the insect pests, the important ones are : (*a*) pyrilla, and (*b*) various types of borers. As regards pyrilla, we are still looking for a sure method of defence. Stripping of the cane in August has had some success in the United Provinces but does not seem to have spread as a defence measure.

Against certain borers, we are still trying the method of breeding and releasing insects parasitic on the borers.

In Louisiana, the sugarcane borer (*Diatraea saccharalis*) has again become a menace. The U. S. Department of Agriculture Bureau of Entomology and Plant Quarantine and the Louisiana Agricultural Experiment Station have recently issued a joint report recommending dusting with cryolite (a sodium aluminium fluoride). The cost works out at 5½ dollars per acre with a power dusting machine. Manual application costs more. The method is worth a trial in India. There are also cultivation methods which demand further experimentation.

Sugar per acre : In the areas growing cane for sugar, it is not only a question of cane tonnage per acre but the amount of sugar per acre, which is a function of the percentage of sugar obtained from the cane. This depends on a variety of factors : (1) variety, (2) method and level of manuring (in many parts of India, though not all, high nitrogen manuring reduces sucrose content), and (3) extraction methods.

In *gur*-producing areas, the same problem is present, though not so obvious. The quality of the *gur* is important, depending on : (1) variety, (2) method and level of manuring, and (3) methods of preparation (nature of furnace, type of pan, clarification method, etc.).

So far as *gur*-producing methods are concerned, there is a large amount of information which only requires to be applied. The Imperial Institute of Sugar Technology has recently issued an authoritative pamphlet on the various kinds of apparatus used for *gur*-production, with their relative values and performances.

Conclusions: It is necessary in any area to decide what part sugarcane cultivation is to play in the general agricultural economy. In parts of Peninsular India, for example, the financial success of an irrigation project may depend on sugarcane cultivation, and it is here that very high yields can be obtained. Arising from such a decision are the questions of what areas are to be allotted to it and where these are to be located, what type of rotation is to be allowed and where the produce is to go. The troublous times through which the United Provinces and Bihar industry has passed indicate clearly the need for long-term planning and rigid control otherwise chaos results. The need for all-India planning is also obvious: otherwise we have violent competition between different sugarcane-growing areas of India. There is also to be considered the possible drift of sugar factories into the Indian states. It is plain that India has now the capacity (in spite of present apparent shortages) to supply all her own sugar requirements and to export.

13. Cotton

Cotton cultivation is scattered over many parts of India which are very different in soil and climate. The cotton produced is therefore of many different types. One of the first questions that must be asked is, what type or types of cotton do we wish to produce in future? The table below is a reproduction of the Indian cotton crop of 1940-41 season classified according to staple length, from Statistical Leaflet No. 1 (1940-41) published by the Indian Central Cotton Committee.

	Bales of 400 lb. each (Government official forecast)
Long staple—over 1 inch, Punjab-American 289F (including 289F/K25) and Cambodia Co3 and Co4	103,000
Medium staple A—1 inch (including Punjab-American 289F/43, Sind Sudhar, 289-F 1, part of 1027 ALF and part of Cambodia Co2)	249,000
Medium staple B—$\frac{7}{8}$ to 31/32 inch (including part 1027 ALF, part Cambodia, Jaywant, Punjab-American LSS, 4F, Jarila, etc.)	1,888,000
Short staple A—11/16 to 27/32 inch (including Salems, Dharwar-Upland, C.P. No. 1, Oomras, Hyderabad Kumpta, Upland, Banilla, etc.)	1,106,000
Short staple B—9/16 to 21/32 inch (including C. P. Nos. 2 & 3 Oomras, Khandesh Oomras, Barsi and Nagar Oomras, Dholleras, etc.)	1,425,000
Short staple C—17/32 inch and below (including Bengals from the United Provinces, Rajputana, Sind and the Punjab, also Comillas)	1,305,000
Total ..	6,081,000

Of cotton above 1⅛ inch the supply is nil, of cotton above $1\frac{1}{16}$ inch staple the supply is small and uncertain, of cotton up to 1 inch, there was in 1939 not only enough for all Indian mill requirements but also an exportable surplus.

The long-term policy of the Indian Central Cotton Committee and of the Agricultural Departments working in cooperation with it has been to establish a better balance between short staple and medium staple cottons. Great progress has been made in this direction. Since the Indian Central Cotton Committee commenced work in 1922, the production of medium and long staple cotton has gone up from 1,249,000 bales in 1921-22 to 2,735,000 bales in 1942-43 an increase of 1,486,000 bales. In 1939, except for the shortage of cotton above $1\frac{1}{16}$ inch, India was in sight of a reasonably balanced production except for the fall in Japanese and Continental takings of short staple cotton. These takings are, of course, now non-existent. Indian mill takings of short staple cottons have always been comparatively inelastic. Mill takings of medium staple cotton below 1 inch are more elastic and these cottons of course stand a much better chance in the world markets.

Takings by Indian mills of African, Egyptian and American cottons were entirely governed by price so far as staple lengths similar to those produced in India were concerned. But for the really long-staple stuff, India had to import from these sources.

The production by a cotton breeder of the Bombay Agricultural Department of Jarila, a high ginning cotton of ⅞ inch staple suitable for a large part of the Oomras area of Bombay and the Central Provinces has markedly altered the situation there. It may be useful to give by provinces and states a very brief summary of actual achievements and future possibilities in the way of the production of improved cotton types.

Sind: Imported Egyptian and long staple American cottons have been a failure. Punjab-American has been a marked success, particularly the following: 289F, Sind Sudhar, and M4.

There appears to be no reason why most of the 686,000 acreas (1942-43) under American cotton in Sind should not be under cotton of 1 in. to $1\frac{1}{16}$ in. staple producing, say 250,000 bales.

Madras: The area (552,000 acres) under production of the valuable Cambodia cotton is relatively stable and there is little margin for increase unless irrigation facilities are extended. As a result of the distribution of the improved strain Co2 it is probable that the supply of cotton of $\frac{15}{16}$ to 1 in. staple will rise to 200,000 bales. Recently the Cambodia and Uganda crosses, Co3 and Co4, with a staple length of $1\frac{1}{32}$ to $1\frac{1}{16}$ in. have been spreading in parts of this tract and their production amounted in 1942-43 to 23,000 bales.

Tinnevelly and Karunganni: An improved strain of 15/16 in. staple (K1) has largely replaced the cotton of ¾ to ⅞ in.) but this does not mean any marked change in the general balance of supply, though definitely advantageous.

Westerns and Northerns: Improved types (Hagari 1 in the Westerns tract and N14 in the Northerns tract) have been introduced, with similar improvement in staple, but no great change in the character of the supply is expected.

Bombay, Baroda and adjoining states: The Surat crop has been rehabilitated but only maintained in its present position by constant efforts,

including the enforcement of the Cotton Transport Act and the maintenance of a special seed supply organization. The Surat cottons are most valuable to Indian mills and the best is in the top medium staple class. Any surplus would meet a ready demand for export. The Surat cotton area has suffered for years from an unfortunate controversy due to the simultaneous introduction of two strains ALF 1027 and 1A. This controversy is now likely to be settled by the production and spread of a hybrid between 1027 ALF and IA named SUYOG which will give a staple spinning the same counts (24s to 30s warp) as 1027 ALF and with a higher ginning percentage, i.e. 35 per cent against 1027 S 32·3 (1942-43).

Broach: The cotton in this area has suffered physically from the spread of the wilt disease and also in reputation and price by the increase of the proportion of Goghari, a short-staple variant with a high ginning percentage. After many years of research in an attempt to combine fair staple, good ginning percentage and wilt resistance, the Bombay Agricultural Department has now produced a variety entitled Vijaya which it is hoped to multiply and spread quickly and which will definitely be a good medium staple cotton.

Dholleras: These cottons occupy 1·8 million acres (1942-43) with a production of nearly 3 lakhs bales, the main variety being Wagad which is $\frac{3}{4}$ to $\frac{7}{8}$ in. and is capable of spinning 16s to 18s warp. A curious feature of this variety is that the bolls do not open when ripe. They are consequently picked in one lot and the seed cotton is extracted by crushing the bolls. The Bombay Agricultural Department has recently produced a variety called Suwag to replace this type with an improved staple. It has been suggested that this name be changed.

Bombay Province, Southern Division: The Kumpta cotton has been greatly improved by the introduction of a better-quality, wilt-resistant variety known as Jayawant evolved by a cotton-breeder of the Bombay Agricultural Department. The Dharwar-American cotton has also been improved in the same way through a better strain of that type. The output of the two improved varieties now reaches 82,000 bales. The yields per acre in the Southern Division are still low and the problem needs more attention.

Oomras cottons: Mention has already been made of the outstanding success of Jarila, which is now considered to have spread over an area of 746,000 acres (1942-43) in the Bombay Province, in an area of 1,874,000 acres in the Central Provinces and Berar and an area of 500,000 acres in Hyderabad State. The total number of bales of Jarila now being produced is 423,000 in 1942-43. Jarila is now the basis of the East India Cotton Association's contract.

Hyderabad: Of the medium staple cotton called Gaorani, an improved type, named Gaorani 6, has an annual production of about 140,000 bales. The best Gaorani spins 30s compared to 24s with a better ginning percentage and represents about 40,000 bales of the above total. It is believed this finer cotton is suitable for an area of 450,000 acres representing eventually an addition of 75,000 bales of full $1\frac{1}{8}$ in. staple cotton to the Indian supply. The late Sir Bryce Burt, just before he left India in April 1939, made the following estimate of the probable production 'in the near future' of cottons of different lengths of medium and long staple cotton :

[*Production in thousands of bales*]

	1 1/32 in.	1 to 1 1/32 in.	15/16 in.	7/8 in.
Punjab	60	140	100	600
Sind	..	150	..	150
Madras				
Cambodia	..	40	120	60
Karunganni	..	..	30	100
Tinnevelly				
Northerns	..	..	..	28
Westerns	..	..	..	29
Bombay				
Surat	..	20	100	80
Broach	..	..	..	10
Kumpta	..	..	75	30
Dharwar Upland	..	..	..	20
Khandesh	..	..	..	5
Central Provinces and Berar				
Verum	..	..	..	50
Hyderabad				
Gaorani	..	..	70	70
Total ..	60	350	495	1,223
	410		1,718	
Actual Production 1940-41 ..	357		1,888	

What is now clearly required is the production of longer stapled American cotton varieties for Sind and the Punjab. The Indian Central Cotton Committee has for the past three years been financing research at Mirpurkhas for this very purpose. Progress up to date has been rather slow and it seems desirable that more money and effort should be applied to this question.

In the Punjab, there has for many years been a Cotton Botanist who has devoted his whole time to the improvement of both American and *desi* cottons. While he has a considerable number of new varieties of 1 1/16 in. staple, none of these so far appears to be likely to oust on a big scale 289F/K25 and 289F/43. For the *desi* cotton in the Punjab, the cotton-breeder has now produced two or three useful and approved substitutes such as Jubilee cotton.

In both the Punjab and Sind the admirable reputation of the American cottons has in the past often been dimmed by mixing with inferior cotton, a practice which was in the past defended in Sind and was definitely encouraged by the Japanese who asked for cotton with particular proportions of mixture.

We can now take up the question of improvement in yield.

Cotton yields: The diversity of conditions under which cotton is grown and the diversity of types is reflected in the difference in average yield in different provinces and states and in different parts of the same province and state

The standard yields for each province and state and, so far as is known, for sections of provinces and states are given in the publication entitled *Quinquennial Report on the average Yield per Acre of Principal Crops for the period ending* 1936-37.

The Cotton Forecast Improvement Committee of the Indian Central Cotton committee has for years been endeavouring to improve cotton statistics and in certain cases has altered the standard yield of particular areas in an attempt to get the final result nearer to the actuals as shown from the baling returns. In addition, crop-cutting experiments have been carried out in the Punjab and elsewhere and there is now being carried on under Dr. Panse, Statistician of the Institute of Plant Industry, Indore, a scheme in which a new method of estimating crop yields is being tried out. Allowing for the vagueness of these standard yields, the position comparing cotton yields in India with those in other countries (1937-38 yield per acre in lb.) is as follows :

Egypt	531
Peru	508
Anglo-Egyptian Sudan	277
Argentina	151
Soviet Union	322
United States of America	264
Brazil	154
Uganda	84
India	89

In various provinces and states throughout India, attempts have been made to force up the yield of cotton Dr. Panse recently reviewed all the experiments hitherto done in India on cotton manuring. His own statement is so important and interesting that I give it in full at the end of this cotton section.

In addition to improvements in manuring, cultivation and rotation, considerable increases in yield can be obtained by the control of pests and diseases. The spotted bollworm, which bores into the buds and young bolls of the cotton plant and causes them to drop, can be effectively controlled if, after the harvest, the cotton stumps are removed from the ground, with their roots, before a specified date, leaving some six weeks or two months in which there is no cotton on the ground, so that the insect cannot be carried over from one season to another by living on shoots coming up from the old roots in the ground. This eradication of cotton stubble has been proved effective in the Gujarat Division of the Bombay Province, in the Baroda State, the Punjab and in Hyderabad State, the implement used being either a specially made plant-puller (which, in pre-war days, could be made for a rupee) or in the Punjab a specially made *kudali*. The rest of the operations are entirely labour. For the pink bollworm the heating of the seed in the sun is an effective remedy.

The damage caused by the spotted bollworm varies from province to province. (*i*) In the *Punjab* the damage amounted to 47 per cent. in the case of 4F and 65 per cent in the case of *desi* in 1935. In 1936 it was 10 and 26 per cent respectively. (*ii*) The researches carried out at Parbhani showed that the pink and spotted bollworms were together responsible for a loss of 25 to 33 per cent of the annual crop. (*iii*) In Bombay the damage to buds was from 34 to 51 per

cent ; 20 to 69 per cent of the shed bolls were found damaged by the worms and the damage to *kapas* in 1928-29 to 1930-31 ranged from 4·7 to 19 per cent. *(iv)* No estimate of damage has been made in Baroda. It is stated that in Baroda the uprooting of cotton stalks resulted in an improvement of 12 to 16 per cent in yield. Bombay recorded 25 to 30 per cent.

Against white-fly and jassids, there is as yet no effective remedy, but certain varieties (e.g. 289F/K25) seem to stand up to these pests better than some other varieties.

Intensive research on jassid-resistance is definitely required as jassids reduce yield very considerably in the Punjab and Sind.

Of fungoid and fungus pests, wilt and root-rot are the most important. Against wilt, the only defence is the breeding of resistant varieties and in several cases plant-breeders have been highly successful in finding these. The brilliant work of Dr. B. N. Uppal of Poona gives us the prospect of producing cotton races that are 100 per cent immune to wilt.

Against root-rot there has not so far been any sign of varietal resistance and the main indications from work carried on by Dr. Vasudeva in the Punjab are late sowing and the use of other crops, particularly pulses, grown between cotton lines.

In the Punjab and Sind, at intervals of a year or two, there occur what is called' 'cotton failure' or *tirak* in which the bolls open prematurely, the seeds are empty and the lint scanty and poor. Prof. Dastur of the Royal Institute of Science, Bombay, subsidized by the Indian Central Cotton Committee and the Punjab Government, has for years been working on this problem and has now discovered that two sets of soil conditions are associated with the development of *tirak*:

(1) soils which contain alkali salts in the subsoil from the second or third foot downwards, and

(2) soils with extreme nitrogen deficiency. These soil conditions may exist together or separately.

(3) Certain remedial measures were tried out with considerable success. The application of nitrogen as sulphate of ammonia to light sandy soils deficient in this element has proved very beneficial in reducing bad opening of bolls and in increasing crop yields, but this method is ineffective on sandy loams with saline subsoil. In the latter case *tirak* can be prevented by late sowing in June and by application of heavy irrigations at shorter intervals, beginning with mid-August. Late sowing reduces vegetative growth and prevents water-deficit in the crop, while, on other hand, heavy and more frequent irrigations supply enough moisture to the crop from the upper non-saline layers of the soil. It has also been shown that late sowing contributes to reduction in *tirak* even on soils deficient in nitrogen. Late sowing, however, adversely affects the production of bolls per plant, but this disadvantage can be remedied by thicker sowing.

The Mexican boll-weevil has fortunately been kept out of India by the rigid practice of fumigating all cotton coming into India. The black-arm disease (a bacterial disease) which does so much harm in Africa, is also unknown or insignificant in India.

To summarize, the prospects of increased yield in India are due to:

(1) improved variety (meaning increase in actual *kapas* per acre, increase in ginning percentage, resistance to pests and diseases, resistance to *tirak*.

(2) The utilization of a suitable rotation so that cotton is not grown after cotton and comes after a crop which does not depress the yield but increases it.

(3) The utilization of manure both organic and artificial according to schedules worked out to suit the soil requirements and having reference to the prices of the manure and the value of the produce.

In considering the technological possibilities of cotton production in India we should not forget two outlets for cotton products, i.e.

(1) the utilization of cotton-seed, and

(2) the utilization of cotton fabrics in new ways.

Cotton-seed is fed to working bullocks and milch animals. In the Punjab (though not apparently elsewhere) there has been a prejudice against feeding to milch animals fuzzy cotton seeds (i.e. those produced by the Punjab-American variety 289F/K25) of which there is a large and increasing supply. The *desi* cotton has no fuzz on the seed. A carefully planned feeding experiment, financed by the Indian Central Cotton Committee, was carried out by the Punjab Agricultural Department and the results obtained indicate that, in so far as the quality of the milk, ghee and butter produced by the group of animals fed on fuzzy cotton seed is concerned, there is no distinguishable difference in characteristic taste or palatability from similar products from the buffaloes fed on ordinary rations. In fact, the experiments have confirmed the previous finding that the food value of fuzzy cotton seed is higher than that of other cotton seed. There were also absolutely no ill effects on the animals fed with fuzzy seed.

Cotton-seed pressing for oil production is not as yet done on a large scale in India but may increase. Associated with this is the delinting of the seed, giving linters', valuable at present, but with a fluctuating value in the past.

As regards new uses for cotton, this has been carefully studied in the United States of America. An important document dealing therewith was published in 1939 by the Marketing Section of the A. A. A. (U. S. Department of Agriculture) entitled *Diversion of Cotton and Cotton Products from the Normal Channels of Trade* by Myers, Omohundro, and Salant. This discusses, with experimental evidence and photos, the employment of cotton fabrics for houses, bale coverings, lining ditches and canals, anti-erosion work, fumigation tents, road surfaces, etc.

The Technological Laboratory of the Indian Central Cotton Committee is experimenting to see if Indian cotton can by chemical means be made suitable for belting and motor tyres. At present India has no cottons of the staple length (mainly $1\frac{3}{16}$ in.) required for such purposes.

Prospects: The planning of targets for cotton production is difficult as any consideration of this crop at once involves national and international policy. Roughly, I suppose, we may look on the production of 1940-41, given in the beginning of this section as a sort of maximum for peace conditions, with a continuing endeavour to shift the centre of gravity of staple length higher and higher, and particularly to develop staple of $1\frac{1}{16}$ in. and above.

MANURING OF COTTON IN INDIA

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The general level of yields of agricultural crops in India is low and cotton is not an exception. While accurate figures are not available, the average yield of lint is most probably not greater than about 200 lb. per acre for irrigated cotton and about 75 lb. for rainfed cotton. These estimates compare poorly with the reported yield of 450 lb. per acre in Egypt and 350 lb. in the Sudan, in both of which countries cotton is grown under irrigation, while the average production per acre in the United States of America, where cotton is not irrigated, is as high as that of irrigated cotton in India. Cotton is grown over a large part of India and as a cash crop plays an important role in the economy of the Indian farmer. The need for increasing its yield is therefore obvious. This increase is likely to be brought about more easily by manuring than by attempting to breed higher yielding varieties. In the first place, improvement of quality is rightly considered to be the primary objective of the cotton-breeder in India today and if a simultaneous increase in yield is also sought, it will render his task more difficult. Secondly, only a small increase in yield may be reasonably expected through breeding, and though the grower will secure it without any cost to himself, this cannot provide the solution of the problem of poor yields.

Sound recommendations for manuring can be made only on the basis of adequate experimental evidence. The collection and interpretation of the necessary evidence is not a simple matter either, owing to the wide range of conditions under which cotton is grown in India. As the first step in tackling the problem, the Indian Central Cotton Committee decided that all available results of cotton manurial trials carried out in different provinces in the past should be critically examined. The information thus made available, besides its possible use for immediate practical application, would serve as a guide in planning future trials. The results of this examination are briefly described in the present article. It is proposed to publish the full report separately.

India may be divided into two main cotton tracts, (1) the Indo-Gangetic alluvium and (2) Peninsular India. In the first tract, both *desi* and American cottons are grown on irrigation with the exception of a small proportion of *desi* grown on rain in the United Provinces and the Punjab. Cotton is entirely dependent on rain in the second tract, except Cambodia, which receives irrigation on red soil in Coimbatore and Salem districts in Madras. Black cotton soil is the principal soil type of the tract and *desi* the predominant variety of cotton grown.

Results of over 100 trials were examined. Trials on rainfed cotton in Peninsular India were the most numerous and consequently more information on the different aspects of manuring of cotton in rainfed areas could be extracted from the data than was possible for the irrigated tract. It is also in the former tract that yields are particularly low and the need for raising them by suitable manuring the most urgent. Before summarizing the results, it is necessary to point out that manurial trials were restricted in the past to research stations and Government farms whose number is too small, considering the vastness and heterogeneity of the area on which cotton is grown. Again, the fertility of land and other agricultural conditions at these farms are usually superior to those met with in the surrounding district. The representativeness of the trials and of the conclusions derived from them is limited by these factors. A verification of the results by extensive trials under cotton growers' conditions is certainly necessary.

The manures tried may be divided into three classes: (1) inorganic or artificial fertilizer such as ammonium sulphate, nitrate of soda or superphosphate; (2) organic manures like oil-cake or bone meal and (3) bulky manures such as farmyard manure or compost. Nitrogen, phosphate and potash are the three chief plant food elements supplied through the manures either singly or in combination to the plant. Of these manurial constituents only nitrogen was found essential for increasing the yield of cotton both under dry and irrigated conditions. Potash proved to be without any value in all areas. Phosphate also showed no beneficial effect on yield over any large tract and is clearly of no general importance. In certain trials, however, as for example at Dabhoi in Gujarat, on red soil of rather low fertility at Coimbatore and at Okara in the Punjab, increased yield has been obtained by the application of phosphate either alone or in combination with nitrogen. These results indicate that there are patches of soil where cotton responds to phosphate manuring and further trials should be directed towards marking out areas where the nitrogenous manuring of cotton might be profitably augmented by the addition of phosphate.

To the general increase in yield brought about by nitrogen, two exceptions were observed. These are:

(1) In the irrigated tract, presence of soil salinity prevents the crop from responding to the fertilizer. This explains the heterogeneous nature of results obtained at Lyallpur, including an adverse effect on the crop in some cases. Prof. Dastur's recent experiments in connection with the failure of the cotton crop in the Punjab have clearly demonstrated the close relationship between the degree of soil salinity and the response of cotton to application of nitrogen. In these experiments, the average increase in yield from a given amount of nitrogenous fertilizer in light sandy soil free from salinity was over eight times the response observed on land with a highly saline subsoil.

(2) In rainfed areas, manuring is not effective where rainfall is low. Under the more extreme conditions it may even depress yield. This is illustrated by the results of manurial trials carried out at

Dhulia in West Khandesh district in Bombay and at stations situated in a belt running from west to east, and embracing the southern end of Bombay and portions of Madras north of Mysore State. The rainfall in this tract is precarious and the annual averages ranges between 20 and 25 inches. With such low rainfall, manurial trials do not appear worth while. The problem here is one of making sufficient moisture available to the crop and not of manuring

A comparison between artificial fertilizers and other nitrogenous manures available from local sources is of particular interest. Artificials were mostly used for supplying nitrogen to the crop in trials on irrigated cotton in the Punjab and Sind; but *toria*-cake which was tried in a few experiments in the Punjab gave promising results and requires further trial For rainfed cotton grown in black soil, groundnut cake appears to be an excellent source of nitrogen and there is evidence to show that its efficiency may be even higher than that of ammonium sulphate. A probable explanation is that under the uncontrolled moisture conditions prevalent in rainfed areas a part of the nitrogen from ammonium sulphate is lost without being utilized by the cotton plant, whereas nitrogen from the cake becomes more gradually and steadily available. Since the cultivation of groundnut in the black soil tract is extensive and is yet increasing, the problem of profitable utilization of the cake as a cotton manure deserves close study. *Neem*-cake was tried at Koilpatti in the extreme south of the peninsula and also gave very promising results. Castor-cake is not on the whole as good as these cakes and appears more variable in its effect.

For equal amounts of nitrogen added, farmyard manure or compost generally gives a much smaller increase in yield than either artificials or cakes. The nitrogen content of farmyard manure is low, being only 0·5 per cent compared to 8 per cent of groundnut-cake and 20 per cent of ammonium sulphate, and its release in a form suitable for the use of the crop is dependent on the stage of decomposition of the manure and the amount of moisture present in the soil. Under certain conditions, farmyard manure might even utilize the nitrogen and moisture in the soil for further decomposition, thereby depleting the supply of these elements available to the crop. With sufficient rainfall and with irrigation this manure is more consistently useful.

The view that artificials should preferably be applied in mixture with organic manures has received considerable emphasis in the past: but the present results do not support it. There is no evidence to show that such mixtures confer any special benefit on crop yield, beyond that to be expected from the effect of the individual components. This is illustrated by trials in which mixtures of groundnut-cake and ammonium sulphate were employed On the other hand, there are some trials in which artificial fertilizers in combination with farmyard manure or after green manuring have proved less effective than when applied alone.

The question of vital importance with regard to manuring is whether and under what conditions it will pay Its consideration involves not only the increase in yield obtained but also the ruling prices of manure and of cotton. For evaluating profits, it is necessary to formulate the relationship between the amount of manure and the corresponding increase in yield, by trying a wide range of manurial doses under representative conditions. The present results are not adequate for this purpose either with regard to the amounts of manures used, which were generally low, or the representativeness of the trials. Recommendations on probable profits from manuring or on the optimum doses of manure cannot therefore be made at this stage and will be possible only when more comprehensive trials are carried out. An examination of the available results on the basis of prices prevailing in the pre-war period (1928—37) indicates, however, that, for rainfed cotton, groundnut-cake is a profitable manure over a somewhat wider range of prices than ammonium sulphate. The most profitable dose of both manures appears to be in the neighbourhood of 40 lb. of nitrogen per acre, that is 500 lb. of the cake or 200 lb. of ammonium sulphate. With regard to farmyard manure, the expected increase in yield from its application is too small to leave any profit after paying the cost of the manure. It may be concluded that buying farmyard manure for manuring cotton is not profitable, and the limited supplies of this manure that are available would on the whole be put to a better use by manuring cereals preceding cotton, particularly in areas with a moderate rainfall.

Manuring of irrigated cotton is naturally more profitable because of the larger increases in yield secured from each unit of nitrogen applied. The optimum doses of manure would also be larger and results from two or three experiments with ammonium sulphate recently carried out in the Punjab suggest that the most profitable dose may be as large as 80 to 100 lb. of nitrogen or 400 to 500 lb. of ammonium sulphate per acre. Under suitable conditions there is thus scope for manuring cotton on a really heavy scale. Manuring of cotton at this rate is not uncommon in Egypt.

An important function of manurial trials is the study of optimum conditions for manuring. For example, manuring done at the right stage would result in a larger increase in yield than if it were done too early or too late. Results of past trials provide some definite information on the proper time for application of manure. For the irrigated American cotton in the Punjab and Sind applying manure during intensive flowering is shown to be optimum. This period corresponds with the latter part of August in the Punjab. For rainfed cotton on black soil manuring near about the sowing time appears to give the best results, except possibly in areas with a higher rainfall, where it might be delayed without disadvantage up to some six weeks after sowing. Cotton in Gujarat (Bombay), which is botanically different, produces a more prolific vegetative growth and matures later. Trials at Surat show that for this cotton, addition of manure six weeks after sowing would result in a higher yield than an early application.

Among other factors that might influence the response of cotton to manuring, the fertility of land and the nature of the season, which is chiefly reflected in the seasonal rainfall in the rainfed tract

are likely to be more important. Fertility is difficult to define in terms of the physical, chemical or other properties of the soil, since too many known and unknown properties are probably involved; but yield which represents the integrated result of all these may be taken as a single measure of fertility or our present purpose. Examined in relation to the fertility of land, results of manurial trials both on irrigated cotton in the Punjab and on rainfed cotton in black soil lead to an apparently unexpected conclusion. It is found that a greater increase in yield is obtained by manuring cotton on fertile land than on poor land. In other words, soil conditions which are favourable for a higher yield also appear to enhance the response of cotton to manuring.

The adverse effect of soil salinity on the manuring of irrigated cotton in the Punjab has been referred to earlier. The fertility of land will also be affected by this factor, and yield on land with a greater degree of salinity will be smaller than on land with less salinity. This relationship seems to provide a plausible explanation for the above conclusion in respect of irrigated cotton. Results of trials on black soil with both artificial and organic manures indicate that at least some of the poor land in this tract is primarily characterized not by a deficiency of essential plant nutrients, but by bad drainage and consequent waterlogging, which interferes with the growth of the cotton plant and its capacity to respond to manuring. This reasoning is supported by the fact that the decreased effect of manuring on poor land becomes particularly noticeable in a year of heavy rainfall. This point is illustrated below by results obtained at Indore in 1937 and 1938 from a total of 19 manurial trials.

Increase in yield of *kapas* in lb. per acre from 125 lb. of ammonium sulphate (25 lb. of nitrogen).

	1937	1938
Fertile fields	96	86
Poor fields	60	14
Rainfall (inches)	38·6	50·3

Improvement of drainage and prevention of waterlogging are necessary before the full benefit of manuring poor land may be realized. The adverse effect of heavy rainfall, though in a less severe form, is probably of a general character, and we may anticipate that the average returns from manuring would be reduced in years of high rainfall. At the other extreme, the futility of manuring cotton under conditions of a precarious and low rainfall has been commented on previously.

This is the brief outline of conclusions derived from an examination of the results of past trials. The need for conducting more trials before recommendations on the manuring of cotton can be made with confidence has been emphasized already. These trials must form part of a well-defined programme and provide comparisons over a wide range of quantities of nitrogen, supplied through different sources, including locally produced oil-cakes. For working out optimum doses of manure, a knowledge of the precise nature of the relationship between the amount of manure applied and the increased yield obtained is essential. Among factors that might raise the efficiency of manuring, the method of applying the manure deserves attention in the rainfed tract where manure broadcast on the surface is liable to be washed away by heavy showers. The alternative of drilling it close to the seed-furrow is likely to preserve it better and make it more easily accessible to the young seedling. A comparison between drilling and broadcasting the manure should therefore be included in the trials in this tract.

When a number of factors relating to a problem require trial, the old practice was to try one at time. If for example different kinds of manures and different quantities of nitrogen were to be compared, different manures at a single dose fixed arbitrarily were included in one trial and different doses of nitrogen supplied through a single manure were tried in another trial. By doing so, information on the relative value of different manures at different levels of application was entirely missed. Modern experiments are therefore designed to compare simultaneously as many factors as possible. When several factors are involved, the experiments, however, become complicated and, have of necessity to be confined to research stations and Government farms: but as soon as results suitable for practical application become available, the trials must be extended to private fields in order to verify the results under the cotton growers' conditions. A large number of such trials have, to be carried out to obtain conclusions of a representative character. The utmost simplification in the design of the trial is necessary, so that an ordinary farmer can conduct it with only a little assistance and supervision. Trials of this nature form a vitally important part of any programme of agricultural improvement, and the farmers' cooperation is essential for their success.

14. Jute

Jute is an important fibre crop of which India has the practical monopoly, although, whenever the price has risen, there has been a threat of the growing of substitutes in other countries and of the substitution of cotton for certain of the purposes for which jute is used. Apart from its strength, its cheapness is its great asset and the menace of substitutes is likely to become serious only when their economics are such as to allow them to compete with jute in normal times.

Bengal is the main jute-growing province, but jute is also found in Assam, Bihar, Orissa and a small area in the United Provinces. The latest acreage figures for each of the jute-growing provinces are :

	1942-43
Bengal	2,755,955
Assam	284,400
Bihar	232,900
Orissa	23,500
United Provinces	10,000
Total ..	3,306,755 acres

(*The Jute Journal* of July 1943 estimates only 2,984,805 acres.)

The graph and tables in Chapter I have already indicated the fluctuations partly due to season, partly due to price, partly due to restriction which the total jute acreage has in the past undergone.

The technological outlook is as follows :

Varieties : Work on variety selection was started by the Bengal Agricultural Department in 1904. In 1915, they produced a variety (in the Olitorius group) which is still the standard variety in that group, viz. Chinsurah Green. In 1909, they produced D154 which is the standard variety in the Capsularis type. When the Indian Central Jute Committee was started in 1936, further plant-breeding work was initiated by the Director, Jute Research Laboratories, at Dacca. Various promising selections and hybrids have been made, but there has not yet been time to evolve anything strikingly better than the existing standard types. The Bengal Department of Agriculture claims that, of the Capsularis jute, 33 per cent of the area is under D154 and. of the Olitorius, 75 per cent under Chinsurah Green. The multiplication and further spread of these improved types is being taken up by the provinces concerned but there has always been a complaint that the present system of seed multiplication and sale by a particular company to whom the Bengal Government entrusts the work is not the best way of spreading the improved seed more quickly.

Variety is not, however, the dominating factor. The following *quotation states the case :

' *Factors influencing quality* : From the Calcutta and Dundee assessments of Capsularis and Olitorius samples, it is evident that localities and seasons profoundly influence the quality of the fibre. Apart from the influence of the season on the crop, it may also affect the retting. A favourable season may provide abundant retting water (leading to cleanliness of the fibre), quicker retting on account of higher temperatures, and more sunny days which would help in drying the fibre properly, thus improving the lustre and probably the strength also. It would be interesting to evaluate the effect of the season on the crop, as distinct from its effect on the preparation of fibre.

' Is there anything peculiar to the soils of these localities that helps in the production of superior fibre ? In this connection the following quotation

*(From ' A Review of Agricultural Investigations on Jute in India ' by J. S. Patel and R. L. M. Ghose. *Indian Central Jute Committee Agricultural Research Bulletin, No.* 1, 1940, pp 18-19).

(from leaflet 11 of 1936) of the Bengal Department of Agriculture is illuminating. "Jute can be grown on most soils of good depth and quality, but the best fibre is obtained on loamy soil. Clayey soil gives the heaviest yield, but the plants do not ret uniformly and sandy soil produces coarse fibre." On the other hand, it is possible that the better quality may be due to the superior facilities for retting.

'Unfortunately, very little evidence is available on any of these points. A survey of the soil and retting conditions in these localities seems to be called for. In any case, advantage can be taken of these localities in crop-planning. Since the jute markets want a better grade fibre, in any scheme of restriction of jute production, a higher quota should be allowed for those localities which produce fibre of superior quality.'

From 1924 to 1933, trials were conducted every year with the departmental strains D154 and R85, with Fanduk (a variety appreciated by the trade) and also the local type of each centre. During the 10 years the trials were conducted at 26 centres, but in any one year the trials were not at all the centres. All the operations from sowing to production of fibre were done according to the local practice at the respective stations. Five-pound samples of unsorted and uncut fibre were taken out and sent to the Indian Jute Mills Association and the Dundee Chamber of Commerce for assessment of quality. Results of the assessment were that the departmental strains produced fibre which was in no way inferior to that produced from Fanduk or the best local type, and that locality, methods of preparation of fibre, and growth, environmental and seasonal conditions, rather than the seed determined the quality. Thickly sown plants gave better quality than thinly spaced plants. A later study of the results also indicated that (*a*) the samples in 1930 were significantly better; (*b*) the differences between the varieties were not significant; no variety proved definitely superior in quality; and (*c*) in general certain localities produced better quality fibre than others. For instance, Rangpur fibre was better than the fibre from Kishoreganj, Dacca, Sarisabari and Haldibari.

Manurial trials: The earlier work was confined to the Dacca Farm, where the laterite soil is deficient in lime and phosphates and hence the addition of these gave improved results. Of the other experiments, the most important is that compost made with water hyacinth gave highly significant results in yield when applied in 1916-17 and 1917-18.

Work on manures done since the creation of the Indian Central Jute Committee shows that a significant increase in yield was obtained from the application of sulphate of ammonia and chloride of potash and that chloride of potash also checks stem-rot. A manure containing nitrogen, potassium and calcium proved the most profitable. This manure gave a yield of 20 maunds of fibre per acre as against 8·2 maunds with farmyard manure alone. The percentage of stem-rot was 18·7 as against 38·5 in the farmyard manure plot and the net gain Rs. 25 per acre (with jute selling at Rs. 6 per maund) over the farmyard manure plot. Considering that the general average yield as calculated from Bengal crop-cutting experiments is about 15 maunds, this is a very interesting result.

Rotation: Early experiments at Burdwan indicated that both *Aman* paddy and potato grow well in rotation with jute. On low-lying land a good crop of *Aman* paddy could be obtained, while on high irrigable land potatoes might be grown after jute in the same year.

Other cultivation methods: There is a fair amount of information as regards the best spacing and the best time for harvesting.

Diseases and pests: *Chlorosis*: This is mottling of the leaf (common in Capsularis but rare in Olitorius) the cause of which so far is unexplained, and which does not seem seriously to affect yield. Stem-rot, however, due to a soil fungus, is serious. This appears to be carried by seed and the most effective means of checking it so far has been treating the seed with Ceresan (an organic preparation of mercury). In pre-war years the cost was moderate, being not more than 4 annas for 10 lb. of seed sufficient to sow one acre. Of the insect pests, the chief is the jute Apion, the grubs of which feed on the tissues inside the jute stem. The present research on this pest is concentrating on finding parasites which will kill the weevil that does the damage.

The Director, Jute Agricultural Research Station, Dacca, and his collaborators are devoting a good deal of time to the study of the development of the fibre in the jute plant, i.e. how it is laid down, the position of its growth and how it is affected by various treatments. They are also studying the whole process of retting, i.e. what actually happens, how and why the tissues disintegrate, what organisims are involved, whether the nature of the retting water has any effect, and so on. It is certain that, from these experiments, it will be possible to evolve a standard retting technique which should improve the quality by about 20 per cent.

Prospects: The directions, then, in which we can look for progress are these:

(1) complete covering of the area with improved varieties,

(2) higher yields and less disease incidence as a result of manuring,

(3) better quality as a result of standard retting technique.

The aim should be an over-all yield of 20 maunds per acre with quality as follows:

Root-cuttings less than 15 per cent good lustre, colour and strength; freedom from faults: fibre not less than 6 ft. With the above acre-yield, it would require only 2,250,000 acres to obtain the last year's yield of 9,000,000 bales as against the actual acreage required which was 8,300,000 acres. Such a condition of things would set free still more land for good crops. It is presumed that the Bengal Government will continue even in peacetime to control the jute acreage.

15. Fibres

With the exception of cotton and jute, Indian fibre plants have received spasmodic and ineffective attention. The indigenous fibre plants are: sann-hemp (*Crotalaria Juncea*), Deccan hemp (*Hibiscus cannabinus*), coir (from the coconut), and *Agaves*. In addition, the following plants have been grown on experiment stations and in Government gardens, viz. rozelle (*Hibiscus sabdariffa*), bowstring hemp (*Sanseviera trifasciata*), ramie (*Boehmeria nivea*), Manila hemp (*Musa textilis*), New Zealand hemp (*Phormium tenax*), while, in recent years, experiments have been carried out with flax (*Linum usitatissimum*). There are two plants which grow wild in certain parts of India, viz. *Thespesia Lampas* and *Urena lobata*, which in other countries are being tried out as jute substitutes. This applies also to rozelle. Banana fibre (*Musa sapientum*) has also been experimented with. The reason why so little effective attention has been given to all these fibre crops is presumably because, with the exception of sann-hemp,

they do not interest large business firms and, until recently, when the pressure of war compelled attention to sann-hemp for camouflage nets, this trade went its way, taking what it got from unorganized production, products which were some times good (as in the case of Ganjam sann-hemp) and sometimes bad (as in the case of Benares sann-hemp). The quality of exported sann-hemp is, however, controlled. The Government of India issued a notification under section 9 of the Sea Customs Act prohibiting, with effect from 1 December 1942, exports of sann-hemp not graded in accordance with the sann-hemp Grading and Marking Rules, 1942.

Such research on sann-hemp as has so far been financed by the Imperial Council of Agricultural Research has been mainly in connection with (1) improvements in cultivation, such as the finding of the best seed-rate, (2) improvements in processing, such as determination of the best time to cut the fibre and the best methods of retting, (3) methods of producing pure seed from improved varieties, a matter of great difficulty on account of the peculiar nature of the pollination of the flower.

It is now fairly plain that the most important and urgent question is the improvement of retting and this is, in the first instance, a question of devising means to provide a sufficient amount of clean water. In sann-hemp growing areas, any drive for increasing the water supply should have as its objective not only drinking water and irrigation water but also water for retting.

Sisal hemp (*Agave sisalana*). There is very little of the true sisal in India. The leaf of the true sisal has no hooks on its margin but only one terminal spine. It is much better in quality than the fibre of any other agave. It can be grown in agreat number of places but, up to date, with the exception of one or two small estates there has been no attempt made to grow it on a commercial scale, presumably because of the capital investment required and the amount of land needed; also the water facilities and the transport which a big-scale sisal plantation demands. At one time, about 35 years ago, there was a move to grow sisal in the tea districts of Bengal and Assam, the results of which are chronicled in a book by Mann and Hunter. But this line of work was not pursued. At Powai, near Bombay, a certain Dr. Suter started a plantation which later became derelict. A missionary called Windsor carried out some experiments in the Ahmadnagar district of the Bombay Province and also invented a simple hand fibre-extracting apparatus. Sisal has been grown in jail compounds in various parts of India (e.g. Nagpur) for jail industries. There are one or two well-run estates of moderate size in Orissa of which one at least uses its own fibre for making its own cordage.

Capt. Steer-Webster attempted to develop sisal in Cutch but without result so far as I know. Some years ago an important Indian East African firm (Karimji & Co.) sent over one of their staff to explore South India with the idea of starting a plantation there, but this came to nothing. Mr. Oakley who, I believe, is an engineer in one of the chrome mines in Mysore, has from time to time written on this subject. I am not aware that he has had much success in developing the plantation of sisal.

It seems doubtful whether, after the war, India should attempt to compete in the sisal market, particularly in view of the enormous fluctuations in price which the fibre has undergone in the past and of the large supplies which were previously available from East Africa. Along roads, canals and railways in India, there are grown three species of *Agave*, viz. *Agave Wightii*, *Agave cantala* and *Agave Vera Cruz*. *Agave Wightii* used to be regarded as useless for fibre

as the leaves are short (though it makes an admirable hedge plant and presents what is really a serried front of fixed bayonets) but its fibre has recently been spun into yarn by the Ganges Rope Company, Calcutta. *Agave cantala* and *Agave Vera Cruz* are already to some extent exploited by the castes or tribes which handle fibre in different parts of India.

In the Bombay-Deccan, for example, the Mangs cut *Agava cantala* and produce fibre by retting in ditches or canals, the materials then being used for country ropes. The trouble about exploiting these supplies is that they are spread out in long lines over wide areas of country and offer enormous difficulties in collection and fibre extraction.

It is understood that the Department of Education, Health and Lands has recently been considering the whole fibre situation and is about to appoint an officer for the study and exploitation of such fibres as are available and that a preliminary survey has been made for this purpose.

The future lines of action would appear to be:

(1) An all-out drive to improve the quality of sunn-hemp.

(2) The establishment of Government plantations of sisal and Manila hemp for the purpose of determining whether they will or will not pay (and with the possibility of losing the whole investment).

(3) The establishment of a fibre research station in some suitable area for studying the agricultural, commercial and technological possibilities of all the other fibres which have so far been mentioned and particularly whether or not to go on with flax and sisal on a commercial scale; here, again, with the possibility of losing the whole investment but, at least, getting exact knowledge once for all.

16. Tobacco

Tobacco is grown throughout India. The latest figures of acreage for the provinces and for the states of Hyderabad, Mysore and Baroda being as follows:

Area in acres under tobacco in provinces and certain states in India in 1940-41

(From *Estimates of Area and Yield of Principal Crops in India*, 1940-41)

Province or State	*Total area*
Assam	15,000
Bengal	322,000
Bihar	108,000
Bombay	174,000
Central Provinces add Berar	9,000
Delhi	1,000
Madras	311,000
North-West Frontier Province	15,000
Orissa	31,000
Punjab	61,000
Sind	6,000
United Provinces	72,000
Baroda	51,000
Hyderabad	55,000
Mysore	27,000

While tobacco was in the past almost entirely grown for use in *bidis*, in the *hooka*,-for chewing or for snuff, the modern development is the growing of tobacco for use in cigarettes. The centre of this has, so far, been the Guntur district of Madras Province and the main stimulus to production of this leaf has been the activities of the Indian Leaf Tobacco Development Company, a subsidiary of the Imperial Tobacco Company of India. Although India is actually the largest producer of tobacco in the world (the figures in 1935-36 were 1,543 million lb., being 21·1 per cent of the total world production of 6,393 million lb., the actual Indian export in 1935 was only 27 million lb. or about 2 per cent of the previous year's crop of 13 million lb.

War conditions and the imposition of the limit of 13 per cent as the maximum proportion of American tobacco to be put into cigarettes made in India have increased the demand in India for Indian-produced cigarette leaf. The main developmental problem is how to increase the amount of first-class cigarette leaf in this country both for internal consumption and for export.

There will, doubtless, also be a steady limited market for tobacco for cheroots and cigars made in India and for pipe tobacco for export. The demand for tobacco for the *hooka*, chewing and snuff will probably continue much as it is, but it is likely that the demand for *bidi* tobacco will be affected by the growing habit of smoking cigarettes.

The technological position is as follows :

Varieties : There are some half-dozen varieties, mostly of American origin, now under test, and one or two of these are being widely grown, particularly Harrisons Special and Adcock. The others under trial are White Burley, Bonanza, Gold Dollar, Flanagan, and Amarelo ; and there are also certain varieties evolved at Pusa such as Pusa Hybrid 142 and Hybrid 177. It was previously believed that American varieties grown in this country deteriorated and that it was necessary to import seed at least every second year. It is now proved, through experiments carried out by the Imperial Economic Botanist, that this is not true. If the varieties are kept pure by bagging, there is no deterioration. For a time the United States of America placed an embargo on the export of tobacco seed and it appeared as if India would have to produce her own seed supply. It is not known whether this embargo continues and whether it is likely to last after the war.

Soils and climates : While Guntur is for the present the main centre for cigarette tobacco, it is by no means proved that it has the only type of soil or climate where cigarette tobacco can be grown successfully. In fact, so far as India is concerned, we are not yet able to say authoritatively exactly what climates and soils will suit tobacco and what will not. Tobacco actually does thrive in a great variety of soils and climates. The production of high-grade cigarette leaf may, however, demand something more special but, even so, certain climatic and soil defects may be got over by artificial means. In Baroda, for example, since the climate is dry, a conditioning cellar is in use.

It is the same regarding soil. Soil can be modified by manuring, particularly with bulky manures. Attempts have been made to draw comparisons with American tobacco soils and to come to the conclusion that Indian soils containing mica are peculiarly suitable for tobacco ; but such arguments do not rest on a sure foundation. The plain fact is that until we try out simultaneously a group of varieties in several different climates and soils throughout India, we shall not have the information we require regarding the suitability of soils and climates for the production of good cigarette tobacco.

Manuring: Tobacco manuring has in several countries and particularly in America, been worked on to such an extent that definite fertilizer formulas have been devised for particular areas and are made known by the Agricultural Departments concerned. Such definite instruction is, for example, contained in a leaflet issued in 1941 by the North Carolina Agricultural Experiment Station. It recommends two different formulas (one for heavy and more productive soils, one for light or less productive soils), indicates the sources and qualities of manures to be used in the mixtures, how to modify these mixtures to influence quality of leaf and how to apply the mixed manure.

Experimentation in this country has not got very far but the results from the last four years of the Guntur tobacco research station so far as they go, are as follows:

Nitrogen, whether applied by itself or in combination with potash and phosphate, improves yield. On cured leaf its effect is to increase the weight and improve the body. The colour of the leaf, however, tends to be adversely affected. The application of phosphate induces earlier crop maturity.

There are indications that suitable manuring of the seed bed has a beneficial effect on the subsequent transplanted crop.

It will be necessary to lay out manurial trials in the various tobacco-growing tracts to determine the most economic manures for each tract, keeping in view, when planning the trials, the results obtained at Guntur.

Other practices: The practices of topping and suckering (*i.e.* removal of the top of the plant and removal of side shoots) are carried out in most tobacco-growing countries and are a practice insisted on by the Indian Leaf Tobacco Development Company in India. They are, however, by no means universal and experimentation is still necessary as to their applicability in the growing of good cigarette tobacco here.

Pests and diseases: The most important pest is the parasitic plant whose scientific name is *Orobanche* and is known by a variety of Indian names such as *tokra*, *bambaku*, etc. The seeds of this are minute, easily mixed with the soil, easily carried about in soil on the feet of men or animals, easily blown about in the dust. The parasitic plant grows rapidly, seeds rapidly and only the most intense plant-to plant hand-weeding will keep it down. This is seldom given and the weed gets a permanent footing. Intensive research is required to find some other way of combating this pest. Other pests and diseases are comparatively unimportant with the exception of tobacco mosaic and tobacco leaf curl (both virus diseases) regarding the treatment of which we are also rather helpless.

Processing the tobacco leaf: The cigarette leaf must be specially cured in flue-curing barns where heat is applied indirectly to the air of the barn through pipes. Flue-curing is an art requiring both intelligence and practice, i.e. the curer must know why certain temperatures and humidities are being used, what their effect is on the leaf and must also have a trained eye and hand for appreciating the stages of curing and the results of his handiwork.

These results (i.e. the cured leaves) have then to be divided up into different grades of leaf, mainly on the basis of colour and texture. In 1937, legislation applicable to the whole of British India was passed to provide for the grading and marking of certain agricultural produce including tobacco. The Agricultural Produce (Grading and Marking Tobacco) Rules issued under this law in

March 1937 prescribe grade designations, definitions of quality, methods of marking and packing for unmanufactured flue-cured and sun-cured Virginia and sun-cured country tobacco. This grading is not compulsory; but the grower or dealer can, if he wishes, obtain an official grade for the produce he wishes to sell.

This standard grading has, however, had little success. The Indian Leaf Tobacco Development Company has its own set of standards and other dealers have their sets of standards; but it is plain that until there is a uniform set of standards, there is not much chance for improving the export market for Indian tobacco in competition with the tobacco of other countries.

After the useful leaf has been taken away in one or other grade, there remains a certain amount of useless material which could be used either as it is for making simple insecticides or for the industrial extraction of nicotine and the making of nicotine sulphate for high grade insecticides. The nicotine content of tobaccos differs considerably and if the manufacture of nicotine products ever became important, it might be desirable to grow, specially for that industry, tobacco varieties with a high nicotine content.

The final test of tobacco is, of course, the opinion of the expert smoker. In addition to being light-coloured and fine-textured, cigarette tobacco must also be mild and neutral in flavour and have a good fire-holding capacity, i.e. burn evenly and slowly. As tea quality is judged by the expert tea taster, so cigarette tobacco quality should be judged by the expert smoker. It is merely a waste of time and money to attempt to estimate so elusive and personal a thing as tobacco quality by chemical analysis.

Conclusions: (1) The amount of cigarette tobacco produced in this country in the last year for which we have figures is 99,841,000 lb. It may be taken that this tobacco was produced from 110,188 acres estimating an yield of 906 lb. per acre. This cigarette tobacco acreage is mainly in Madras Province (Guntur and adjoining districts), Mysore State, Hyderabad State, the United Provinces and Bihar.

(2) Attempts should be made to try out a group of cigarette tobacco varieties in various provinces and a scheme has already been prepared by the Agricultural Commissioner with the Government of India in which 18 such centres are suggested. At each of these centres, proposals have also been made for simple manurial trials and for trying out the practices of topping and suckering.

(3) As good flue-curing is an essential part of cigarette production, the training of expert flue-curers is essential. It is understood the Imperial Council of Agricultural Research is arranging for the training of a limited number of curers at Guntur and it is suggested that this process should be speeded up.

Grading: It is highly desirable that some kind of uniformity in grading should replace the present welter of systems.

Tobacco is a crop of such value that it would pay to use on it artificial manures and the exact formulas for different soils should be worked out and applied as soon as possible. It may also pay to use hybrid seed and thus exploit hybrid vigour in the same way as has been done with maize in the United States of America. Preliminary work on this has already been done at Pusa and Guntur. During the cold weather of 1943-44 the most promising hybrids will be tested on a field scale.

Given these conditions, we may look forward to a total acreage under cigarette tobacco of 200,000 acres which should give us annually 150,000,000 lb. of good flue-cured tobacco.

As regards tobaccos for other purposes, I suggest that, for the moment, they be left alone, and when the cigarette tobacco business is on a sound footing, we may turn our attention to them.

17. Fruits and Vegetables

In Chapter I, there is given a table and graph of fruits and vegetables, including root crops. This is unsatisfactory. It is necessary to have really accurate statistics for fruits and vegetables separately. It is indeed highly desirable to have statistics for the areas under different *kinds* of fruits and vegetables.

FRUITS

In the early days of the Agricultural Departments in India, fruit culture was neglected, except at a few places. At Pusa, Quetta, Lyallpur, Peshawar, Poona and Nagpur a certain amount of work was carried on. From 1933 the Imperial Council of Agricultural Research began to finance provincial and state schemes on fruit research and these are now in existence in Madras, the United Provinces, Bihar, Orissa, Coorg, the Punjab, the Central Provinces, Assam, the N.-W. F. P., Hyderabad State and Mysore State. In addition, the Imperial Council of Agricultural Research financed, for several years, a fruit preservation scheme in the Punjab, is still financing (from year to year) another scheme connected mainly with fruit and vegetable preservation at Lyallpur and a similar scheme at Quetta. In addition, it financed for several years cold storage research schemes at Poona and Lyallpur.

Research in fruit growing is slower in giving results than work on annual crops, since with one or two exceptions, fruit trees do not start bearing before the third or fifth year and are seldom in full bearing for another five years. Moreover, they are widely spaced, occupy a lot of ground and so offer difficulties in (1) getting sufficient space for an effective experiment station, and (2) providing enough trees in order to get statistically significant results from experiments.

Work at the various stations has so far been concerned largely with (1) the comparison of different varieties, (2) the comparison of different rootstocks on which to bud or graft, (3) the technique of vegetative propagation (budding, grafting, etc.), (4) the treatment of certain fungus and insect pests, (5) systems of pruning, (6) application of manure, (7) application of water, and (8) the physiology of flowering, particularly in the mango.

Although, so far as fruit trees are concerned, we have not had the same spectacular results as in plant-breeding or plant management of the annual crops, yet there has been gathered a useful body of knowledge which has been made available to the public in the departmental leaflets of various provinces and states, and in such publications as the *Punjab Fruit Journal*. It cannot be said, however, that there have been any really big mass effects of the research so far done. Throughout very large parts of India, the orchards remain in an uncared-for condition, pruning is either not done or done unscientifically, there is no treatment of pests and diseases and the fruit when produced is either of very poor quality or else astonishingly variable in quality. This state of things has been discussed repeatedly by horticultural workers); but the plain fact of the matter is that, except possibly in the Punjab, district staff is not provided for producing on a large scale the mass improvements which are possible. Plentiful all-the-year-round supplies of fresh fruit are highly desirable from the point of view of

nutrition and also as a profit-making investment to those in a position to invest money over a long term in fruit-growing.

The marketing of certain fruits has been dealt with in one or two reports of the Agricultural Marketing Adviser (e.g. grapes, citrus). One of the main difficulties is the fact that fruit plantations are often small in extent, and widely scattered, making collection, packing and grading difficult. Where fruit-growing has been taken up on a larger scale, as for example, in certain parts of the Punjab and at one or two of the large holdings of rich Saswad Malis in the Deccan Canals area of the Bombay province, things are, on the whole, better done, but there is still tremendous scope for improvement.

The provision of cold storage at assembling centres and also in the larger centres of distribution would prevent the present cycle of gluts and scarcities which characterize trade in most fruits. There are enormous improvements to be made in the actual trade system. These have been dealt with in the Marketing Reports just mentioned and also in the *Report of the Committee on the Improvement in the Marketing of Fruits and Vegetables in the town of Bombay* by Cheema and Shirname, 1934, and *A Survey of the Marketing of Fruits in Poona* by D. R. Gadgil and V. R. Gadgil.

It is impossible to fix, even approximately, targets for fruit production, since we have also little accurate knowledge of the present output, the present demand, the amount and nature of fruit that is preserved as jelly, jam, chutney, juice or canned fruit. All one can say is that the possibilities are enormous, provided (1) so far as preserved fruits and fruit products are concerned, we can stand up to competition from foreign products, and (2) both the quality of the fresh fruits and the methods of their marketing are greatly improved.

Fruit associations have been formed in one or two provinces of which the most live appears to be the Punjab Fruit Development Board, but the Fruit Growers' Association of the N.-W. F. P. also appears to make itself felt.

Since the beginning of the war, much attention has been given to the dehydration of fruits. But, so far as is known, such large-scale dehydration is limited to one or two plants operated on behalf of the Government in the N.-W. F. P.

Surveying the whole field of fruit development, one gets the impression of much uncoordinated activity, full of promise but a good deal of it rather academic and all badly requiring to have more and better attention both from the centre and the provinces and states.

VEGETABLES

It is understood that the Agricultural Marketing Adviser's staff have in preparation a report on the marketing of vegetables following on a short survey of the supply, demand and utilization of vegetables in India. Some such survey was badly required, for reliable data regarding vegetable production in India are non-existent. The war brought a demand for fresh vegetables and revealed the extraordinary difficulty of supplying them, partly due to the scattered and unorganized nature of the business, partly due to the many different varieties grown and partly due to the wartime lack of seed. In 1942, the Imperial Council of Agricultural Research published a very useful bulletin on *Vegetable Growing in Delhi Province*, giving detailed instructions which are applicable practically

anywhere in Northern India. Of vegetables grown in India, we may recognize the following classes, being those mentioned in the publication just named:

(*a*) Beans and peas. These have been grown in India for generations and the seed supply does not offer much difficulty. They are also grown on a large scale as field crops.

(*b*) Tuberous and root vegetables, viz. carrots, beet, radish, potato, turnip, sweet potato, artichoke, globe artichoke, parsnip, salsify, *arvi* or *ghoyan*. With the exception of the potato and sweet potato, these are grown on a smaller scale.

(*c*) Gourds and pumpkins, of which there are numerous indigenous varieties.

(*d*) Vegetables which are the fruits of the plant concerned; Lady's fingers, brinjal, chillies, tomatoes.

(*e*) Salad vegetables: lettuce, mustard, celery, cress.

(*f*) Leaf and stem vegetables: cabbage, cauliflower, knohl-kohl, onion, garlic, Brussels sprouts, spinach of various kinds.

(*g*) Flavouring and seasoning vegetables such as mint.

The cultivation of vegetables other than those grown on a field scale is usually carried on by a gardening class with some hereditary skill as a profitable occupation in the neighbourhood of large centres of population. A plentiful water supply is essential and soil which must either be rich or should have a good supply of manure.

The Punjab is the only province which has a specialist officer dealing with vegetables. There are many varieties in practically all the vegetables. Even the so-called European varieties have got indigenous types which have been in the country for a long time and have got adapted to it. Up to the war, the seed supply of vegetables other than those peculiarly Indian, such as the gourds and pumpkins and brinjals, was obtained from the United Kingdom, the United States of America, Germany and Australia and the cessation of these supplies bore very hardly on the seedsmen and on the vegetable growers in India. The situation is still by no means satisfactory, although the difficulties have been partially got over by (1) the rapid development of vegetable seed production, particularly in Kashmir, at Quetta and Saharanpur, and (2) the import of a certain amount of vegetable seed under Lease-Lend.

But it is to be feared that those who are now practically monopolists in vegetable seed are exploiting their position and it is a fact that the level of prices for vegetable seeds is extraordinarily high.

The Food Section of the Supply Department has gone in for dehydration of vegetables, but I have no figures regarding the areas in which dehydration has been done, the types of vegetable dehydrated; the total amount of the produce, nor how t e stuff produced behaves as to either nutritive value or keeping properties.

It is impossible to fix any kind of target as regards quantity, quality or distribution of vegetable cultivation in the future, and like fruit-growing, it demands much closer scrutiny and control by the centre and the provinces and states.

18. Potatoes

Technological possibilities of development are along three lines:

(1) The production of seed potatoes free from disease in the broadest sense of the term and true to variety and type.

(2) The elimination of fungus diseases which attack the plant in the field.

(3) Improvement of seed storage, including prevention of storage rots, prevention of insect pests, particularly the potato moth, the utilization of cold storage and the devising of storage facilities in areas where cold stores are at present out of the question.

The varietal position has been thoroughly studied by Dr. B. P. Pal, Imperial Economic Botanist, and Dr. Pushkar Nath, in charge of the Simla Potato-breeding Station. Potatoes were probably introduced into India about the 17th century. Varieties thus introduced have become thoroughly acclimati zed, are grown over wide areas in India, have lost their original names and are usually known as *desi* varieties. In collaboration with the Potato Research Station at Ormskirk in England, some of the most important of the *desi* varieties have been identified. The varieties grown under a great number of different names in India can be reduced to three main types mainly grown in the hills. These are No. 1, commonly known as Phulwa or Patna White, No. 2, commonly known as Darjeeling Red, No. 3 commonly known as Gola.

In the hills in Northern India, Magnum Bonum, Royal Kidney and Up-to-date (locally called Numbri in the Punjab, and Long Keeper or Garud in the United Provinces) are popular. In the Madras Province, practically the whole of the potato-producing area, which is in the Nilgiri hills, is under the variety Great Scot. Previous to the war of 1914-18 and in the interval between that war and the present one, large quantities of Italian potatoes were imported into Bombay, mainly from Naples, and were used as seed for potato cultivation in the Bombay Province and in Sind. The first Great War and the shortage of seed resulting therefrom led to useful research by Mann, Nagpurkar, Ajrekar and G. S. Kulkarni into methods of storing potato seed and into the question of protection against storage rots an d storage insects. This knowledge, reinforced by experience in the meantime, has been recently applied by Dr. B. N. Uppal in similar work carried out at the Poona College of Agriculture during the present war. Fungus diseases attacking the plant in the field vary from place to place. In the Bombay Province, for example, and in the 'plains' generally, blight (due to *Phytophthora infestans*) is unknown, whereas this disease is common in the hills of the Punjab, the United Provinces, Bengal and Assam. Early blight, caused by *Alternaria Solani* is common in the hills of the Punjab but normally not so severe in the United Provinces hills. On the plains it has been observed in the United Provinces, the Punjab and occasionally in Bihar. The Bombay potatoes suffer a good deal from soil fungi such as *Fusarium* and *Rhizoctonia*, both of which can also be storage rots, and from a bacterium that infects the tubers from the soil.

The potato moth is comparatively easily dealt with by fumigation with petrol in simply constructed iron chambers.

The Simla Potato Experiment Station financed by the Imperial Council of Agricultural Research contains valuable collections of potato varieties, many of them from the original home of the potato in South America (mainly Chile, Peru and Bolivia), collected by various expeditions, Russian, German and English. The Imperial Council of Agricultural Research was largely responsible for financing the last-named expedition. These varieties have been used for crossing between themselves and with *desi* and English varieties and some of the hybrids are now ready for multiplication on a larger scale. The main difficulty so far has been to find land and facilities for this multiplication at a height

intermediate between that of Simla and the plains where the potatoes will largely be grown. This work needs to be expedited.

The main causes of the so-called deterioration or running out of potato varieties are virus; diseases. These diseases take the foremost position, firstly because of their heavy toll on yield which may suffer 92 per cent loss depending on the causal virus; secondly, because there is no other way of controlling them on a mass scale except by the certification system; thirdly, because of their highly infectious nature.

The plants raised from infected seed tubers serve as a source of infection and the majority of virus diseases cannot be discerned in the tubers themselves and none of them can be determined with accuracy in this way alone. Consequently, for the production of disease-free certified seed, plants have to be examined several times while they are growing and seed plots intended for certification must be isolated and located in places where conditions for natural transmission of these diseases are unfavourable. A majority of these diseases are transmitted by sucking insects, i.e. aphids, etc. The localities where these insects are either absent or occur in extremely small numbers and where the conditions for their movements within the crop are unfavourable are most suitable for the production of disease-free certified seed.

At the request of the Imperial Council of Agricultural Research Dr. G. Watts Padwick, Imperial Mycologist, suggested such a system of seed certification for India, if India wishes to see a prosperous potato industry based on sound foundations, and the Imperial Council of Agricultural Research has for the last two years been financing a survey for the purpose of discovering areas where natural transmission of these diseases is negligible or low. Dr. Padwick and Dr. R. S. Vasudeva, Assistant Plant Pathologist, have discovered that certain localities in the higher hills are quite suitable for this purpose and that the average aphis incidence on the potato crop as observed during this period varied from 0 to 4 per hundred leaves as against 750 (highest) per hundred leaves observed on the plains. Certain localities on the plains also show a low aphis incidence during the first main crop and would seem quite suitable for the multiplication of the nucleus disease-free seed produced in the hills, but this needs to be confirmed in subsequent seasons.

In the light of the information obtained, the Imperial Council of Agricultural Research has decided to establish a central station in the higher hills for the production of nucleus disease-free certified seed which will be later multiplied on the plains by certified growers under the supervision of inspectors trained by Dr. Padwick at the Imperial Agricultural Research Institute.

Cold storage of potato seed is definitely a success wherever it has been tried. Potatoes either for consumption or seed can be kept in cold storage at 35° F for at least nine months and are in no way affected as regards their germination or yielding capacity by such treatment. This is the ideal way of storing seed potatoes through the hot months in India. Any other system involves a percentage of loss which in the most favourable circumstances will not be less than 10 and may be up to 50.

Manuring: Potatoes in all countries respond very markedly to manure. In both Britain and India the best results are got by farmyard manure. In the Nilgiris, there has been a good deal of manuring with artificials and there sulphate of ammonia and calcium superphosphate have been used, the plants appearing to require phosphorus. The Madras Agricultural Department at one time also sold its own potato fertilizer mixture.

The manures found most suitable, as a result of experimentation, in several potato-growing areas are as follows :

Province	*Manures and fertilizers (quantities per acre)*
Assam	.. Nicifos 225 lb.+sulphate of potash 225 lb.
Bombay	.. Farmyard manure 18,000 lb. and 200 lb. of sulphate of potash, superphosphate and sulphate of ammonia.
Madras	.. Farmyard manure 5,000 lb.+1,610 lb. of Nanjanad mixture (500 lb. groundnut-cake, 850 lb. steamed bone meal, 336 lb. concentrated super and 224 lb. sulphate of potash).
Bihar	.. Ammonium sulphate, superphosphate and potassium sulphate sufficient to give 75 lb. of N_2, 35 lb. of P_2O_5 and 75 lb. of K_2O.
United Provinces	200 maunds cowdung + 20 maunds of castor-cake.

Yields : The following are a few examples of typical yields of manured and unmanured potatoes in the same areas :

Province	*Yield in lb. per acre of manured and unmanured potatoes*	
Assam ..	Manured ..	10,140
	Unmanured ..	7,590
Bombay ..	Manured ..	15,324
	Unmanured ..	7,000
Madras ..	Manured ..	20,000
	Unmanured ..	8,275
Bihar ..	Manured ..	14,000 to 15,000
	Unmanured ..	Figure not available
United Provinces	Manured ..	10,944
	Unmanured ..	5,776

Prospects : Given disease-free seed-potatoes and suitable manuring, the production of potatoes on the existing acreage can be doubled.

Section II : LIVESTOCK

Chapter I—LIVESTOCK PRODUCTION

Every animal has a certain inherited capacity for production and this will be expressed in full in its milk yield, wool, work, etc., if the environment in which it lives is ideal. The actual production will be short of the full inherited capacity to the extent to which the environmental conditions are short of the ideal. For examining livestock production, therefore, the present division of the country into provinces and states on the basis of administrative convenience is not suitable. It is necessary to divide the country into regions according to

environment. Climate, being the main and immutable factor of the environment, affords a reasonable basis of division, and accordingly India has been divided into three climatic regions as indicated in the attached Statement I. The first or the wet region has a rainfall of 70 to over 100 inches and comprises the west coast of India, Bengal and Assam. The second region has a rainfall of 30 to 60 inches and forms the middle of India. The dry region with rainfall of less then 30 inches is made up of the north and the north-west of India. As can be imagined, the conditions in the different units which make up a region are by no means identical. There are indeed wide variations caused by the physical features of the country, but broadly these three regions represent a gradation of the general conditions which influence the efficiency of livestock production.

It may be pointed out at the outset that there are various difficulties in dealing with the subject for the whole of India. Figures of the Livestock Census form the starting point of the basis of all estimates. A census has been taken every five years, but every census does not cover the whole of India. In some years certain provinces have not taken part in the census, and never has the census covered the entire area occupied by the states. Again, in the latest census taken in 1940, figures are not yet available for the different districts of each province. There are other factors, like the periodical splitting of one district into two, or combination of two districts into one, or the constitution of new provinces, etc. It has accordingly been decided to confine this review to British India (except in regard to sheep) and to base all estimates on figures ascertained at the 1935 census. The variations in population are not very large at each quinquennium, and if the estimates are taken to apply to 1940 the error will not be considerable. An attempt was made to get out graphs showing the influence of epidemics of disease and famines on total population, but nothing worth having was obtained.

A reference may be made to the sources from which the figures in the accompanying statements have been drawn. Population figures are taken from the livestock census or from the agricultural statistics of India. Areas under cultivation and areas under fodder crops are also taken from agricultural statistics. The *Report on the Marketing of Milk in India* and the *Village Enquiry Report* (Miscellaneous Bulletin No. 22 of the Imperial Council of Agricultural Research) are the main sources of information regarding milk production. Certain figures in the marketing report were found unacceptable, and adjustments were made in the figures relating to production. The census report of 1940 and the *Report on the Marketing of Eggs in India* are the main sources of information relating to poultry. Here again discrepancies were observed between figures in the two publications and adjustments had to be made from the available information. The *Handbook on the Quality of Indian Wool* and the annual reports of the various sheep-breeding schemes working under the Council were made use of for information regarding wool. Other references utilized in the preparation of these statements were the papers relating to the Fodder and Grazing Committee of the Imperial Council of Agricultural Research, the brief prepared for Dr. Wright, the human Census Reports and proceedings of the Animal Husbandry Wing meetings.

Production

(a) *Cattle*: Production of milk and work are the two main objects of keeping cattle. Statement II shows the output of these two. It is estimated that the capacity for milk production is 870 lb. in region I, 462 lb. in region II and 778 lb. in region III. A total of 18,036 million lb. of milk is produced annually by the 37 million cows available in British India.

There are 49 million bullocks in British India cultivating a total of 264 million acres. Their capacity for work varies from 7·6 acres cultivated per pair of bullocks in region I to 19·2 acres in region III. When divided over the number of ploughs in each region, practically the same figures are obtained.

(*b*) *Buffaloes*: Buffaloes supply only milk. There are 15 million she-buffaloes producing 18,296 million lb. of milk per annum. Their milking capacity varies from 732 lb. in region I to 1615 lb. in region III, which would seem to show that our worst she-buffaloes are as good milk producers as our best cows.

(*c*) *Goats*: There are 38 million goats in British India, but it is estimated that only 15 per cent of them are milked. The rest are males or young stock or are *not* milked at all. On an average milch goats yield 200 lb. per annum. Here also region I is the poorest, with an average of only 74 lb., while region III gives an average of 297 lb. per annum.

Milk production: For convenience of reference milk produced by the different species is put together in a separate table, Statement III, and the production in ounces is compared per day per head of human population. Assuming that all the milk is consumed in the region in which it is produced (which it is not), the daily *per capita* consumption varies from 8 oz. in region I to 12 oz. in region III.

(*d*) *Sheep*: In the case of sheep, the regions have been slightly rearranged with a view to bringing out the importance of high altitude sheep, which are good producers of white wool. Since large quantities of wool are produced in Indian states the latter have also been included in the respective regions in the case of sheep population figures only. Region II has been subdivided, the areas of Kashmir, the North-West Frontier Province and the hilly tracts of the United Provinces, the Punjab and Bengal being grouped in a subdivision, region II*b*. It will be seen from the statement that there is a total of 47 million sheep in India producing in the aggregate 85 million lb. of hair and wool, white and coloured. Out of this, 36 million lb. is white wool produced in regions II*b* and III by 22 million sheep yielding 58 million lb. fleece of varying proportions of medullation.

Poultry: It is estimated that there are 74 million fowls and 11 million ducks in British India or a total poultry population of 85 millions. The figures are obtained from the livestock census of 1940, the Marketing Report being used to fill up blanks in census figures. It is estimated that they produce 1,814 million eggs per annum or 7·209 eggs per year per head of human population. The figure is 12·6 for region I, 5·7 for region II and 8·6 for region III. Egg production is thus comparatively higher in areas where other forms of livestock are poor and *vice versa*.

Manure production: Statement IV contains an estimate of the amount of cattle manure produced annually. There are very few data for working out an estimate. The figures may be taken only as a rough approximation. A total of 839·5 million tons of green manure appears to be produced annually, two-thirds of which is estimated to be used as fuel. The balance of 279·8 million tons or 1 ton per acre of cultivated land is available per annum for fertilizing the soil. In addition, there is the manure available from goats and sheep and other animals.

Fodder Production

The first ten columns of statement V indicate the amount of feeds available in British India. It is divided into two parts: Roughages and Concentrates. Roughages consists of (*a*) special fodder crops like berseem, jowar, etc., which are cultivated, (*b*) the natural grasses available and (*c*) the straws of food crops. As will be seen from column 8, the amount of roughages available works out to 7·37 lb. dry per head per day in region I, 9·52 in region II and 15·17 in region III, the average for British India being 10·00 lb.

Concentrates available consist of oil cakes, seeds, bran and pollard. The quantity available per head per day is 0·14 lb. in Region I, 0·19 in Region II and 0·39 in Region III, average for British India being 0·21 lb. In preparing this statement the entire production of seeds is assumed to be crushed, except cotton seeds, of which one fourth only is crushed and the rest is fed whole.

To make the estimate as conservative as possible it is assumed that the entire cattle feed produced in the country is available to the adult bovines. Such an assumption allows for any possible omission of stray sources of supply of cattle feeds which may have escaped our notice and makes our estimate less vulnerable to the criticism that in our zeal we are exaggerating the deficiency and pitching our demands too high.

It is assumed that the average live weight of cattle is 500 lb. in I region, 600 lb. in region II and 700 lb. in region III. In terms of dry matter the daily requirements per head (at 2 to 2 lb. dry matter per 100 lb. live weight) will be 11·5 lb., 13·75 lb. and 16 lb. respectively in the three regions. Out of these quantities at least 0·5 lb., 0·75 lb. and 1·0 per head per day on the average in the three regions should be provided in the form of concentrates and the rest in the form of roughages as shown in columns 13 and 12.

Chapter II—GROW-MORE-FOOD CAMPAIGN

There is nothing to report under this head on the livestock side, as the only commodity regarding which a special effort has been made is that of ghee, and no results are yet available.

Chapter III—POTENTIALITIES

1. Cattle

Milk: The productive capacity of Indian cattle as shown in Statement II relates to the general run of animals which live under adverse conditions of climate, feeding and management. Such experimental work as has been done on a limited scale indicates that a milking capacity of a higher order is latent in them and can be developed by the application of scientific methods. There are four directions in which scientific methods can be applied. These are: (*a*) feeding, (*b*) breeding, (*c*) management, and (*d*) disease control.

Feeding is the most important of these items and is the factor which might be used to produce an immediate increase in milk production. Even a cursory glance at the statement regarding fodder will show that feeding is hopelessly inadequate. It has been observed that ordinary village cows will produce on an average 50 per cent more milk per head if they are maintained on an adequate

ration. In villages, in general, more than half this increase may be expected by better feeding, and the output shown in the table might be increased by 30 per cent immediately.

Improvement by breeding by the use of pedigree sires is a comparatively slow process. In the case of well-defined breeds of cattle as are found in region III it has been observed that, in selected herds where systematic breeding control and extensive culling have been practised, the average yield has been increased by 400 per cent in about 25 years' time. The improvement in the first generation of progeny from village animals is, however, only 15 per cent and this figure is being taken as the average potentiality under this head. It may, however, be pointed out that such data as are available, relating to grading up work with large numbers of village animals in poor regions, such as in the Anamalai hills (South India), and Bhadri Raj (United Provinces), indicate that a minimum of 100 per cent increase can be obtained in the first-cross progeny of imported bulls from the local cattle.

There are several aspects of management which will increase the efficiency of milch cattle. It is not possible to assess all of them. One important defect is that the calving interval of village cows is 18 to 20 months on the average, more than half of which period is dry. By skilled management it should be possible to breed from them earlier and reduce the dry period by at least three months. This will improve production by a minimum of 15 per cent. In farms the average calving interval of purchased animals has actually been brought down to 14 months.

Contagious diseases like foot-and-mouth disease and parasitic infections affect milk production considerably.

Diseases like rinderpest result in mortality. It is difficult to estimate the loss with any degree of accuracy, but we shall be on the safe side if it is estimated that better control of disease will result in an increase of 15 per cent.

The above are the four aspects of cattle improvement where scientific knowledge can be employed with success for increasing milk production. The increases may be summarized as under :

	Per cent
Feeding	30
Breeding	15
Management	15
Disease Control	15
Total ..	75

2. *Buffaloes*

Milk : Before proceeding to consider work-cattle we may examine to what extent milk production of buffaloes and goats can be increased in a similar way by the application of scientific methods.

Feeding : It has generally been observed that village buffaloes are fairly well-fed and that the actual increase that can be obtained by better feeding is only about 15 per cent in these animals.

Breeding : The improvement possible by the use of pedigree sires will be the same as noticed in the case of cows, viz. 15 per cent in the first generation.

Management : The average calving interval in villages is 18 months, but unlike cows 10 months of this period are wet and only 8 dry. This dry period

can, however, be reduced as in the case of cows, and 15 per cent increase in milk production expected.

Disease control : Will result in the same improvement as in cows, viz. 15 per cent.

This gives a total potential increase of 60 per cent.

3. *Goats*

Extensive evidence is not available in regard to the potentialities of improving the milk production of goats. The general all-India average for goats is 200 lb. milk per head per annum. Work done in farms has shown that an average of 400 lb. or a 100 per cent increase is quite possible. It would therefore be quite safe if we assume a potentiality of 50 per cent increase in the milking capacity of goats.

The above increases will alter the production of milk to the figures given in Statement VII (*a*). The milk available per head of human population will increase to 5·2 oz. in region I, 10·81 oz. in region II and 30 oz. in region III. This is still less than the minimum physiological requirements in regions I and II, but is sufficient in region III—in fact it admits of a surplus for export from this region, if 15 oz. is taken as the figure to aim at.

4. *Work*

No yardstick has as yet been brought into practice in India for measuring the efficiency of bullocks for work, and no records have been maintained. There is no doubt, however, that scientific methods of feeding, breeding, and better disease-control would improve the working efficiency of our bullocks. In the absence of any numerical measure we shall not be unjustified in applying to bullocks the figure of improvement in work corresponding to improvement in milk production noticed in their dams and sisters, excluding improvement due to shortening of dry periods, i.e. 60 per cent, and the result of applying this figure is shown in column 4 of Statement VII (*c*) These figures show the extent to which working efficiency can be improved. We may take 20 acres as the largest area which a pair of bullocks can manage, owing to the time factor which intrudes after a certain level has been reached and this standard has already been reached in region III. No further reduction in numbers is therefore possible in that region. In the other two regions the material available is incapable of rising to the level of 20 acres. Their efficiency can, however, be increased by 60 per cent of the present level, and if this is done the existing numbers of bullocks can be reduced by 4 millions in region I and 10 millions in region II, provided there is some consolidation of holdings or some system of co-operative farming is introduced. Such reduction will materially reduce the pressure on fodder, which is very great at present in these two regions.

5. *Wool*

Since the chief function of sheep is to produce white wool, this has been taken as the basis of estimating potentialities. In region I the population of sheep is so small as to be negligible. In region II (*a*) sheep are largely coloured or produce only hair, with the exception of the N.-W. corner, particularly Kathiawar, where white carpet-wool producing sheep are available. Only regions II (*b*) and III produce white wool, and it has been estimated that their production might be increased at least 100 per cent by scientific feeding, breeding, management and better disease-control. The potential figures are given in Statement VII (*d*) and show that we might well reach a production of 72 million lb. of white wool in a year.

6. *Poultry*

It has been estimated that the annual production of eggs from indigenous hens in India can be increased by the application of scientific methods from 50 to 130 per bird or by 160 per cent. At least half of this or an increase of 80 per cent. is quite possible in the country as a whole. Statement VII (e) shows figures computed on this basis. The total production will then rise to 12·98 eggs per year per head of human population, with a maximum of nearly 23 in region I.

Fodder Production

As will be seen from Statement V, after making full allowances for the fodder available at present, there is a deficiency in both concentrates and roughages. The actual figures are given in columns 16 to 19. It will be seen that the available supply of concentrates and roughages are sufficient for only 29·14 per cent and 78.53 per cent respectively of the existing population.

In the above estimates no allowance has been made for forest grazing. There are 85,000 square miles of forest grazing in India, but this is accessible to only a small percentage of animals. This source can, however, be developed and reserves of fodder can be built up against famines.

Statement I

Areas included in three Livestock Regions of India

Region	Areas in different Provinces		Areas in different States
I Over 70 in.	(1) *Madras* ..	Malabar S. Kanara	(1) *Cochin* .. Whole (2) *Travancore* .. Do. (3) *Deccan States*. Sawantwadi (4) *Assam States* (5) *Bengal States*
	(2) *Bombay* ..	Bombay city Bombay Suburban N. Kanara. Kolaba, Thana Ratnagiri	
	(3) *Coorg* ..	Whole	
	(4) *Bengal* ..	Do.	
	(5) *Assam* ..	Do.	
II 30—70 in.	(1) Bihar ..	Whole	(1) Mysore
	(2) Orissa ..	Do	(2) Kashmir
	(3) Central Provinces..	Do	(3) Gilgit Agency
	(4) United Provinces	Do.	(4) Central India
	(5) *Madras* ..	Chingleput	(5) Gwalior
		Chittoor	(6) Hyderabad
		Coimbatore	Adilabad
		East Godavari	Aurangabad
		Ganjam	Bhir
		Guntur	Bidar
		Kistna	Kasimnagar
		Madras	Medak
		Madura	Nander
		Nellore	Nizamabad
		Nilgris	Osmanabad
		N. Arcot	Parbhani
		Ramnad	(7) Baroda
		Salem	(8) States of Western India
		S. Arcot	(9) Rajputana-Palanpur
		Tanjore	(10) Sandur
		Tinnevelly	(11) United Provinces States
		Trichinopoly	
		Viragapatam	
		West Godavari	
	(6) *Bombay* ..	Ahmedabad	
		Baroch and Panchmahals	
		Kaira	
		Surat	
III Under 30 in.	(1) Punjab ..	Whole	(1) *Hyderabad*
	(2) N.-W. F.P. ..	Do.	Atraf-i-belda
	(3) Sind ..	Do.	Gulberga
	(4) Baluchistan ..	Do.	Hyderabad City
	(5) Delhi ..	Do.	Mahbubnagar
	(6) Ajmer-Merwara ..	Do.	Nalgonda
	(7) Bombay ..	Ahmednagar	Raichur
		Belgaum	Warangal
		Bijapur	(2) Deccan States, except Sawantwadi
		Dharwar	(3) Rajputana except Palanpur
		East Khandesh	(4) Punjab States
		Nasik	(5) N.-W. F. P. States
		Poona	
		Satara	
		Sholapur	
		West Khandesh	
	(8) Madras ..	Anantapur	
		Bellary	
		Cuddapah	
		Kurnool	

Statement II

Livestock production

Regions	Number of milch cows	Milking capacity lb. per head per annum	Total annual milk production of the region	Number of acres of cultivated land	Number of male cattle	Number of acres cultivated per pair of bullocks
	1	2	3	4	5	6
			(*a*) CATTLE			
I	11,029,055	370·6	4,088,005	48,606,519	12,084,329	7·6
II	20,449,022	462 0	9,465,092	137,291,241	28,071,014	9·8
III	5,794,618	773·7	4,483,230	78,168,901	8,169,782	19·2
British India ..	37,273,195	484	18,036,387	264,066,694	48,928,125	10·8
			(*b*) BUFFALOES			
I	730,900	732·3	541,835	..	..	..
II	9,460,368	1,049·6	9,929,245	..	..	..
III	4,845,568	1 615·0	7,825,381	..	..	..
British India ..	15,046,836	1,216	18,296,461	..	..	..
			(*c*) GOATS*			
I	6,043,254	73·9	73,684	..	..	..
II	21,014,943	101·1	602,371	..	..	..
III	10,027,862	207·0	457,881	..	..	..
British India ..	37,086,059	200	1,133,936	..	..	..

*Only 15 per cent of the goats produce milk.

(d) SHEEP

Region	Number of sheep	Average annual yield per sheep lb.	Total fleece produced annually lb.	Average medullation per cent	Total white wool produced annually lb.
	1	2	3	4	5
I ..	351,601	0·86	731,742	..	..
II (*a*) ..	24,557,038	1·07	26,350,524	100·0	..
II (*b*) ..	2,958,139	2·23	6,593,061	12·83	5,716,920
III ..	19,562,749	2 62	51,355,277	41·08	30,259,500
India ..	47,032,527	1·77	85,030,604	37·87	36,006,420

Statement II—concld.

Livestock production—*concld.*

(*e*) Poultry

Region	Fowls				Ducks				Total Poultry		Egg production per head of human population per year
	Total population in millions	Number of layers (millions)	Annual lay per bird	Total annual production of eggs (millions)	Total population (millions)	Number of layers (millions)	Annual lay per bird	Total annual production of eggs (millions)	Population (millions)	Eggs produced per year (millions)	
	1	2	3	4	5	6	7	8	9	10	11
I ..	31·2	10·4	50	520·0	6·4	3·8	90	342·0	37·6	862·0	12·621
II	33·3	11·1	50	555·0	4·8	2·9	90	261·0	38·1	816 0	5·759
III	9·6	3·2	50	160·0	0·13	0·07	90	6·3	9·73	166·3	3·624
British India ..	74·1	24·7	50	1,235·0	11·33	6·77	90	609·3	85·43	1,844·3	7 200

Statement III

Milk production

Region	Annual milk production (thousand lb.)				Human population	Milk production per head of human population oz. per day			
	Cows	Buffaloes	Goats	Total		Cows	Buffaloes	Goats	Total
	1	2	3	4	5	6	7	8	9
I	4,088,065	511,835	73,684	4,703,584	68,343,029	2·02	·31	·05	3·01
II	9,465,092	9,920,245	602,371	19,996,708	141,657,198	2·92	3·07	·10	6·18
III	4,483,230	7,825,381	477,881	12,766,492	15,777,405	4·29	7·19	·11	12·22
British India ..	18,036,387	18,296,461	1,133,936	37,466,784	255,777,632	3·09	3·12	·20	6·42

Statement IV

Annual production of Cattle Manure in British India*

Bovine population in millions			Estimated daily production of manure (u. green)			Total production of green manure				Estimated proportion used as fuel	Balance available as manure (green)	
Adult cattle	Adult buffaloes	Young stock	Adult cattle	Adult buffaloes	Young stock	Adult cattle million lb. per day	Adult buffaloes million lb. per day	Young stock million lb. per day	Total million tons per annum		Total million tons	Per acre of cultivated land (tons)
84	20	44	40	50	20	3,360	1,000	880	830·5	60·6	270·8	1·0

* On a dry basis the quantity will be 40 per cent of that given in the table.

Statement V

Production of Concentrates and Roughages

Region	Production										Requirements					Deficiency			
	Roughages								Concentrates, viz., cakes, seeds, bran and pollard)		Estimated daily requirement per head			Estimated annual quantity required in each region		In million tons per year		Ratio of quantities available to quantities required (in percentages)	
	Total bovine adults (million)	Area under special fodder crops acres	Number of adult bovines per acre of fodder	Estimated total production of special fodder crops in million tons dry	Estimated total production of grasses million tons dry	Estimated total production of "tops" of foodgrains million tons dry	Total roughages produced in million tons per year (total of columns 4, 5 and 6)	Roughages available per head per day in lb. dry (column 7/column 1)	Total available million tons	Available per head per day lb. (column 9/column 1)	Average live weight lb.	Roughages lb. dry	Concentrates lb.	Roughages million tons	Concentrates millions tons	Roughages (column 14/column 7)	Concentrates (column 15/column 9)	Roughages	Concentrates
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
I ..	26·8	489,830	52·6	0·91	13·85	16·1	30·86	7·37	0·574	0·14	500	11	0·5	16·244	2·102	13·311	1·528	66·88	27·31
II ..	61·5	3,152,195	19·5	5·84	41·21	48·3	95·35	9·52	1·924	0·19	600	13	0·75	130·263	7·516	31·448	5·592	73·56	25·60
III ..	19·5	6,901,157	2·8	12·78	12·68	22·8	48·26	15·17	1·231	0·39	700	15	1·0	17·655	3·177	..	1·916	103·41	38·75
Br. India	106·8	10,543,482	10·3	19·53	67·74	87·2	174·17	10·00	3·729	0·21	..	..	..	224·162	12·795	49·762*	9·066	78·53	29·14

*Slight arithmetical inaccuracy will be noticed in this figure. This is due to the small surplus in region III being ignored.

POTENTIALITIES

Estimated increase in production that may be expected as a result of the application of scientific methods

Statement VI

Potentialities of each species of livestock

Species	*Potentialities of increase expressed as a percentage of present production*
Cattle-milk	75
Cattle-working efficiency	60
Buffaloes-milk	60
Goats-milk	50
Poultry-eggs	80
Sheep-wool	100

Statement VII

Potential production

(*a*) MILK

Region	POTENTIAL DAILY PRODUCTION OF MILK PER HEAD OF HUMAN POPULATION IN OZ.			
	Cows' milk	Buffalo milk	Goat milk	Total milk
I	4·58	0·54	0·08	5·20
II	5·11	1·91	0·29	10·31
III	7·51	11·98	0·66	20·15
British India	5·41	1·99	0·30	10·70

(*b*) EGG PRODUCTION

Region	Total poultry population million birds	POTENTIAL EGG PRODUCTION PER ANNUM	
		Total million eggs	Number of eggs per head of human population
I	37·6	1,551·6	22·72
II	38·1	1,468 8	10·37
III	9·73	299·3	6·78
British India	85·43	3,319·7	12·98

(c) Work Production

Region	Area cultivated (million acres)	Total number of bullocks engaged (millions)	Average number of acres now cultivated by a pair of bullocks	Potential number of acres that can be cultivated by improved bullocks	Number of improved bullocks required to cultivate area shown in column 1	Number of bullocks that will become surplus if (columns 2—columns 5), efficiency is improve as in column 4
I	48·61	12·08	7·6	12·16	7·92	4·76
II	137·29	28·07	9·8	15·68	17 54	10·53
III	78·17	8·17	19·2	30·72*	..	..
British India ..	264·07	48·92	10·8	17·28	..	..

*Though the efficiency of the bullocks can be raised to the level of 30·72 acres per pair, it will not be possible in practice to utilize the whole of this efficiency as the bullocks will have necessarily to remain idle for some time. Twenty acres per pair is the maximum that can be dealt with and may be taken as the standard.

(d) Wool Production

Region	Number of sheep	Production of white wool (million lb.)
I	..	..
IIa	..	..
IIb	2,958,139	11·49
III	19,562,749	60·51
Total ..	22,520,888	72·00

Section III :—THE SHAPE OF THINGS TO COME

The function of agriculture is to supply nourishing food for the people and good quality raw material for industry. In agricultural development two objectives must be held clearly in view : (1) the abolition of the poverty of the cultivator, and (2) the abolition of the poverty of the soil.

Increased acre-yields are the indication that we are attacking simultaneously both kinds of poverty. Increased net returns to the cultivator in cash or kind mean that we are getting these increased yields at a relatively lower cost. A good beginning can be made by cutting out several kinds of waste and substituting parallel kinds of savings. These are waste of fertilizing material, waste of water, waste of time, waste of labour, waste of soil, waste of money, waste of livestock. Each of these heads covers a good deal more than appears at first glance. Waste of soil, for example, covers uncultivated (though cultivable land), land cultivated

too seldom, land cultivated with an unsuitable crop, land that goes to the sea in floods, land fragmented. Waste of water covers water that goes to the sea that might be pumped, water that runs off the land that might be impounded, water spilt at the well by inefficient water lifts, water from canals given in excess, failure to tap underground water by means of wells, and so with the others.

In attacking these kinds of waste, priorities must be worked out. These will not be the same for all areas, but in all areas waste of fertilizing material and waste of water will certainly rank high.

In Chapter III, under each crop, suggestions have been made for obtaining better results, mainly under the heads of varieties, manuring, cultivation methods, protection from pests and diseases. Such suggestions can all be classified under one or other of the above anti-waste heads.

What organization is required to have such work carried out? I suggest the utilization of all existing means first and building on these. The existing means are the provincial and state Agricultural Departments and particularly their propaganda or extension sections, and the network of village organizations (farmers' clubs, etc.) associated with them. These provincial and state departments have to be enormously strengthened in trained men, in funds and in authority. Another existing agency which should be utilized to the full is that kind of man who is in control of anything from a single village to a small state, the man variously called inamdar, jagirdar, sardar, taluqdar, or zemindar (in the Bengal and Madras sense), etc. In the Bombay-Deccan and in the Gujerat Division of the Bombay Province these are actually Orders, the Order of the Sirdars of the Deccan, and the Order of the Sardars of Gujerat, existing in three classes of precedence, First, Second and Third Class Sirdars. Apart from these, we have also grantees, limited companies, managers of undivided old estates or zemindaris, and so on. There is no lack of entities with at least the beginnings of organization and the possibility of controlled collective action.

It is becoming increasingly clear that most of the anti-waste measures can only be carried out by collective action. The following are some examples:

Soil conservation is a wholesale business. The bigger the area tackled the better. It is no use if one man constructs *bunds* in his fields if that field is unprotected from wash delivered on it by untreated land above. It is little use one man sweeping up the grasshoppers in his field if the same is not done over every field for miles around. It is no use one man carefully weeding *Orobanche* out of his tobacco, if his neighbour lets it seed. It is no use shooting up wild pigs in one village if, in the neighbouring village they breed like rats.

Even in activities where individual effort would seem to be most rewarded, as, for example, in the proper conservation of vegetable waste material as manure and in the utilization of improved seed, there are great advantages in collective action. Where compost-making has really been taken up on a big scale, it is often done either on contract or by village servants. Collective use of good seed has two main advantages: (1) ensures a high reputation for the area and a corresponding price for its product, and (2) makes year to year seed supply simple.

If at the moment we are not prepared to accept the implication that modern technological methods demand the increase in size of productive units, we must at least admit that technological improvements are impossible without at least collective action by aggregations of units. This point is so clear that it must be made an essential part of any improvement drive. While proceeding with all necessary caution, we must not be afraid of invoking a certain degree of compulsion to ensure such collective action. Persuasion by itself is not enough.

In pre-war India, there existed not only the danger but the fact of the cultivator being bombarded by propaganda of all sorts by all kinds of agencies themselves not working in any coordinated system. I suggest that the managing agency (whatever it is) for an aggregation of productive units for agricultural development should also be the vehicle for the educational health and thrift drives which are likely to be put across with larger force than ever in the post-war world. Unless these various lines of improvement are linked up with and made part of agricultural development, we shall merely have a chaotic welter of competing propaganda with the cultivator bewildered and sceptical in the middle of it all. In conclusion, here are a few facts and suggestions under the headings of some of the main anti-waste lines of action.

Manuring

Indian soils are at a stage in which, on the whole, there is neither increased nor diminished production. Judging from the results of over 5,000 manurial experiments in India and the variability in the yields of no-manure plots, it is probable that in most parts of India soil fertility is stabilized at a comparatively low level. There are, however, indications that improved varieties with a higher uptake of nutrients may depress this level still further. This being so, it is not difficult to ensure increased yield by manuring and especially by manuring with nitrogen, for which the land has the greatest hunger. The sources of nitrogen are: (1) farmyard manure, (2) compost made of vegetable waste matter and with a small amount of cowdung, as a 'starter', (3) urine earth from cattle byres, (4) compost made from town refuse utilizing town night-soil as a 'starter', (5) green manuring, (6) oil-cakes, (7) bones, (8) molasses, (9) other types of industrial waste such as cotton-mill waste not yet tested, and (10) artificial manures, of which the main one is sulphate of ammonia.

Accepting the position that most farmyard manure will still be utilized as fuel, the logical course is to employ a small amount of it as a 'starter' for the making of compost. The objection to compost-making, that it involves labour, must be got over. If the Chinese cultivator can apply to the land every scrap of available fertilizing material, so can the Indian cultivator. It is only a matter of discovering the best way to do it. Excellent compost has been made in Bengal of water-hyacinth and in sugarcane areas of cane trash. This last compost is often made *in situ* on the fields and with rain water only. There is no single way of making compost which can be regarded as the best in all circumstances. If the principles are understood, a method can be worked out for any material and any sets of circumstances.

As regards the possibilities of compost from town waste I give herewith a note prepared by Dr. C. N. Acharya of the Indian Institute of Science, Bangalore:

'The 1941 census figures show that cities and towns of above 5,000 population in India possess an aggregate urban population of 58·33 millions; and the data collected by Dr. C. N. Acharya during the course of a year's work in Bombay Province show that for every 10,000 of urban population, about 1,000 tons of compost manure could be obtained annually. From the waste of an urban population of 58·33 millions, therefore, it would be possible to prepare about 5 to 6 million tons of good quality compost manure every year.

In addition to the bigger towns of above 5,000 population there are a large number of medium-sized towns between 2,000 and 5,000 population managed by

municipalities or village panchayats, which possess sanitary staff for the collection of urban refuse. This category accounts for an aggregate compost producing capacity of another 5 to 6 million tons annually.

It would, therefore, be possible ultimately to supply for agricultural purposes about a crore of tons of compost manure annually by a proper utilization of the urban wastes in India.'

As regards oil-cakes, there are, in addition to the well-known ones from crops such as groundnut-cake and castor-cake, many others from wild plants with a limited range of production which should be fully exploited. Such are *karanj* (*Pongamia glabra*), *undi* (*Calophyllum inophyllum*), *mowra* (*Bassia latifolia*), *neem* (*Azadirachta indica*).

Green manuring is universally a success, provided there is moisture to rot the green manure crop properly before the main crop is grown. If the growing of a green manure crop means the loss of a food or cash crop, it has to be worked out locally whether the green manuring is or is not desirable from the point of view of expediency and profit. The use of molasses appears to be strictly limited, but much further work is necessary on both the manufacture and the use of solid manure made from molasses or from molasses and press mud. The utilization of bones, particularly the double utilization thereof, i.e. both for glue and for manure, is worthy of increased investigation and commercial exploitation. Along with this ought to go the rapid development of small bone-crushing plants, including preliminary treatment by either charring or steaming, so that supplies of this phosphatic manure can be easily had in many centres. While India, before the war, was using about a lakh of tons of sulphate of ammonia per annum, there is no doubt that, if this material were cheap, it could and would be used in a much greater quantity.

All-India calculations are bound to be exceedingly vague and inaccurate, but they may at least give some idea of the order of magnitude of the quantities required. So far as nitrogen is concerned, let us make the following assumptions :

Crop	Acreage in million acres	*Suggested manuring* — Nitrogen lb. per acre	Total lb. nitrogen (millions)
Rice	76	20	1,520
Wheat	33	40	1,320
Barley	6	20	120
Jowar	33	20	660
Bajra	17	20	340
Maize	6	20	120
Ragi	6	20	120
Sugarcane	4	100	400
Cotton	23	40	920
Jute	3	20	60
Tobacco	1·25	20	25
Brassica oilseeds	6	20	120
Castor	1·3	20	26
Coffee	0·20	40	8
Tea	0·8	40	32
Vegetables	0·75	40	30
Fruits	2·5	40	90
(no pulses included)			
Total ..	..	..	5,911

The total required for the above crops, 5,911 million lb. nitrogen, would be contained in 13·2 million tons sulphate of ammonia (N=20 per cent) or 526 million tons farmyard manure (N=0·5 per cent).

Water

It is not proposed to go into the statistics of irrigated and non-irrigated land, the extent and capacity of canals, the number and capacity of wells, in this note. It is plain that wherever additional water can be given that should be applied. Outside the canal areas, the main sources should be the digging of new wells. The first question is, where should a well be dug? This demands a knowledge of the way in which water is held in the local soil and rock. In certain places, if one digs a hole anywhere, some water will be found. In others it is a matter of very careful observation and inference before even a sporting shot can be made at a likely well site. In the Deccan trap, where water runs in fissures, a lucky shot may land on such a fissure, and an unlucky one may be out by merely a few feet. In such areas, the need to eliminate the element of luck and, as far as possible, bring the element of scientific certainty, is necessary, and for that purpose it is desirable to employ, with all the scientific checks possible, water-finding individuals and water-finding machines and to make use of those who have specialized in the geology of the water-bearing strata. Such people do exist and, if mobilized into a water-finding unit, under a provincial or state Agricultural Department, could do a great deal.

They would have to be associated with the agricultural engineer who would require to have an installation of boring machines and sufficient staff to run and repair them.

The next source requiring to be tapped is water from rivers where pumping could be done. The term *rivers* includes such casual water as tail water of hydro-electric systems. With the coming of peace and the cheapening once again of oil-engines and pumps, there is a market for these of enormous proportions, not only for pumping from rivers but also for pumping from ordinary wells, replacing the present bullock gear. For many years before the war, quite a number of well-to-do landowners had installed oil-engines and pumps in their wells. It was comparatively easy to train an intelligent coolie to handle these simple oil-engines and the pump itself needed practically no attention.

As long as we have bullock-driven water-lifts, it is desirable to continue their improvement. Much has already been done in the improvement of the Persian wheel and a little in the improvement of the *moth*. The possibility of using windmills for pumping should also be tried out on a large scale. Previous to the war, these installations could be obtained cheaply from Britain and America and it is rather a curious fact that so few of them had been erected in this country. A windmill requires to have with it a storage tank at a sufficiently high level to irrigate by means of gravity the fields which it is supposed to command. It might be possible to utilize a windmill on the same well and in addition to bullock gear as a stand-by and to save bullock labour.

It is possible to store quite a large amount of water by properly constructed dams on small rivers or even *nullahs*. A good example is the one at Verar a few miles from Jamnagar. Storage tanks of all sorts and sizes down to mere pools are also worth constructing wherever possible. Dr. Padwick, in his report on his visit to China, this year (1943) states that in the province of Szechwan, it is now required by law for every 10 farmers to have a pond for irrigation purposes.

Ponds are wanted not only to supply irrigation to crops but also for drinking water and, in areas where sann-hemp is important, for the retting of that fibre crop. No single measure would so improve this crop as improve dretting technique with plenty of clear water.

In addition, there are many ways of impounding water in areas near hills which do not amount to the formation of ponds but which greatly increase the water in the soil and subsoil. Such are arrangements of broad terraces known as soaking compartments on either side of a *nullah* in certain parts of the Deccan and various other similar works which not only store water in the soil immediately affected but also increase the water levels in the adjacent wells.

Crop protection

Crops have to be protected from fungi, insects, the larger vermin, parasitic flowering plants and the weather. The best remedy against fungi attacking crops is the production, where possible, of resistant varieties. This is the complete answer and where it has been given, the trouble may be considered overcome. The next important method is the use of fungicides, particularly those in which treatment of the seed can be given. Such methods where known and proved, require to be made universal. There is also the necessity for the rogueing out of diseased plants in many types of fungus disease where these would infect other crops and where the number of plants to be rogued out is relatively small. In the case of valuable crops, particularly fruit trees, there is also scope for the application of fungicides by dusting and spraying machines where the value of the crop compensates for the more expensive treatment.

There ought to be a considerable future for the manufacture of fungicides and fungicide applying apparatus in India.

Insects

While there are indications that resistance to attacks of certain insects is also an inherited plant character, the evidence is nothing like so plain nor are the effects so marked as in the case of resistance to fungi. This line of investigation needs to be followed up both to determine the reality of such resistance and also the physics, chemistry and biology of its causation. In the case of insect pests, a direct attack upon them is always costly. Hence the application of insecticides can generally be done only to valuable or intensively grown crops such as fruit trees, high priced vegetables, etc. The application of insecticides wholesale to a field crop is as yet not an economic proposition. Sir Edward Cole has for some years had the idea of using what he calls a smoke screen, i.e. a cloud of heavy vapour carrying in it some element lethal to insects but not injurious to plant life or human beings. Up to date it seems impossible to employ such methods in free air, but in the United States of America the application of gas to crops under the cover of a large movable tent has been in vogue for a long time. There are, however, certain simple measures of direct attack which can be employed by cultivators but are only useful if applied on a large collective scale. Such are the sweeping of grasshoppers by means of broad-mouthed bags, the trapping of insects by lamps at night, the burning of *jowar* stubble and, best known of all, the pulling up of cotton stubble as a remedy against the spotted bollworm.

As in the case of fungicides, there ought to be a large opportunity for the manufacture of insecticides in India (particularly those based on tobacco or pyrethrum) and of machinery for the application of these.

The larger vermin

These include pigs, deer, jackal, porcupine, field rats, squirrels and birds. Here, again, organized wholesale collective measures are essential. The most striking example of these is the gun-club system organized in certain parts of the Bombay Province. In a typical year, viz. 1939-40, these clubs (66 in number) killed 2,210 pigs and 530 nilgai at a cost of Rs. 5,000. The value of the crops so protected was Rs. 1,60,000 or 32 times the cost of protection.

Jackals can be poisoned or hunted by some of the local wild tribes who usually pursue them with miscellaneous packs of dogs. Porcupine can be trapped. Field rats are best dealt with by a campaign of gassing them in their burrows with hydrocyanic acid gas produced from the granular material known as cyanogas. We still have to think out and devise a really effective means of protecting crops from birds.

Weather

While it is obviously impossible to protect crops against most of the vagaries of the weather, there are certain things that can be done. In the Bombay Province the Meteorological Department has developed a system of frost warnings which enables growers of fruit trees, particularly of the valuable grape crop in the Nasik district, to light fires in their vineyards and so reduce damage. The drying effects of strong winds can be greatly reduced by means of suitable wind-breaks, i.e. the growing of tall trees with the intervening spaces filled up by some kind of creeper or twining plants. Such have been effectively developed around peach gardens in parts of the North-West Frontier Province, the windbreak consisting of poplar trees, laced together with climbing wild rose bushes.

It is necessary that the roots of the windbreak should not interfere seriously with the crop which it protects.

In certain fruit gardens the fruits suffer considerably from sun-scorch, i.e. the sides exposed to the sun get burnt and blistered. In such gardens it is distinctly worth while growing between the fruit trees other trees which would give a broken shade to prevent such sun-scorch. The growing of shade trees among the main crop is a common practice in both tea and coffee cultivation and is worth while experimenting with in other valuable plantation crops such as fruit trees, particularly in North India. Finally, the provision of an additional water supply is a protection against dry weather and the provision of drainage a protection against excessive rain.

Vernalization

It seems fashionable at present to suggest vernalization as one of the measures of agricultural improvement which ought to be pushed in India. So far as research on this subject has gone, the practical applications of vernalization in India seem to be meagre. Without going into theory, it may be stated that vernalization, as practically applied, consists in chilling soaked seeds, a process which in certain cases has induced earliness when these seeds are sown. The large-scale application of vernalization in Russia is due to the fact that it enables wheat and barley to ripen in the short season of the Arctic Circle and to grow sufficiently quickly to escape drought in the dry areas of the Ukraine.

In many parts of India, earliness would certainly be an advantage but the Indian crops which actually do show earliness, as a result of vernalization are so far few. None of the Indian wheats show earliness although one or two of the English wheats do. Mustard shows it markedly. So also does linseed. Cotton is doubtful.

Mechanization

The mechanization of agriculture is usually held to mean, in the first instance, the utilization of tractors with suitable implements to do certain operations, particularly tillage. In India such mechanization has already been useful and economical in the following operations :

(*a*) eradication of deep-rooted weeds such as *dhub* and *kans*,

(*b*) in clearing land originally under jungle,

(*c*) in making roads, *bunds* and channels,

(*d*) in anti-erosion work,

(*e*) on large sugar estates and grantee estates where big areas have to be dealt with quickly and efficiently.

The biggest try-out of mechanization for all purposes is to be found on the private estate of His Highness the Maharaja of Jodhpur where the work is being done by Mr. M. P. Fletcher, a man of long experience in this type of work in different parts of India.

A tractor can also be employed as a stationary source of power for many other operations necessary or useful on the farm such as pumping, spraying, threshing, winnowing, chaff-cutting and the grinding of grain.

In Great Britain, under the stress of war, the construction of tractors has increased enormously. In the first quarter of 1939 the number of tractors in Great Britain was 50,000. In September 1939, it was 51,000. In 1941 it was 90,000 and now (1943) it is 150,000.

These are owned and used by farmers of moderate holdings, i.e. of the order of 100 acres or so. Full mechanization is naturally economical on bigger farms, say, of the 1,000-acre order. At the moment, it is unnecessary to say more about mechanization than this :

(1) In the operations where tractors have already proved useful, their employment should be part of those local collective organizations which are mentioned later.

(2) Mechanization other than that involving tractors (i.e. the use of stationary oil-engines) can be taken up whole-heartedly wherever experience shows they are going to be profitable and efficient. On his small estate just outside Srinagar, Sardar Abdul Rahman Khan Effendi uses an oil-engine which drives a Mysers pump to irrigate the garden, operates a chaff-cutter, and grinds corn. Work on bullock-drawn tillage implements has resulted in certain improved ploughs and bullock hoes being designed and, in certain areas, put into mass production. In addition, some useful secondary implements such as drills, *bund*-formers and scoopers have been invented. We need not now put much effort on small alterations in design, but we do need larger tryouts of existing designs from different parts of India and different agricultural engineers. We also need continued study of yokes and hitches, and of the actual manipulation of improved implements, particularly of the iron plough. Much more work is needed on the effects of tillage. It is a proved fact that good and timely tillage has been found to increase yields of cotton and *jowar* by 20 to 30 per cent in Khandesh, by 8 to 10 per cent at Poona, and by 75 to 80 per cent at Mohol (all in the Bombay Province). Year by year one sees, in many parts of India, the plough waiting for the rain instead of preceding it.

One word must be said regarding the belief or rather fallacy that mechanization must result in widespread unemployment. Efficiency means greater

production from the land at less cost. If this efficiency arises from the use of machines to economize manual labour, it would seem to mean fewer men upon the land. This does not necessarily follow. It may mean fewer men per operation but not per acre. There are numerous examples in which modern progressive farming has actually restored the numbers of men employed upon the land. Mechanization, in addition, creates several new classes of employed men, those who make, those who manage and those who repair the machines. It employs, in addition, more groups who are the suppliers or distributors of the spares, the fuel and the lubricants. Mechanization, particularly if it involves the transference of machines from one place to another, involves the improvement of roads, and here, again, a large prospect of employment is opened up.

It should be observed that this increase in employment is not only for men detached from the land but also for many members of the educated classes who at the present moment can find no satisfactory outlet for their education. But this is only the very beginning. An area which has been helped by mechanization may easily give double the income that it gave previously, leaving money, therefore, spare, for the training and setting up in other walks of life of men detached from the land.

Nor need they be detached from the land. Intensive agriculture such as the production of poultry, eggs, vegetables, honey, can be and is best carried on in small areas which could be part of a large system including branches of decentralized urban industry. Everything points to some type of collective organization.

Education, and all that goes with it, depends on having time to be educated and the money to pay for it. If mechanization can help towards both the time and the money, why should it be looked on with suspicion?

In any planning of agriculture for the future, one inevitably turns to the great Soviet experiment. While keeping an absolutely open mind as regards that experiment, I would quote in conclusion a remark by the late Sir Daniel Hall, one of the most level-headed of British agricultural scientists:

'What is, however, worthy of consideration is the fact that the men who planned the Soviet organization, men lacking neither in knowledge of the material world nor a perception of affairs, did deliberately abandon the peasant structure of agriculture to which they had been habituated, and have attempted to replace it by large-scale exploitation of the land, using all the resources of science and machinery. The motive was to obtain increased production, more food for a vast population that was insufficiently fed and liable to famine, and yet at the same time to liberate more labour for the other industries, whereby the total divisible wealth of the population would be increased.'

Statement 1

Acreage and Production of RICE in India

Year	Area All-India	Area British India only	Production British India only
	(Million acres)	(Million acres)	(Million tons)
1911-12	..	66·7	28·2
1912-13	..	68·4	25·7
1913-14	..	66·4	24·8
1914-15	..	66·9	23·3
1915-16	..	68·1	28·4
1916-17	..	70·3	30·4
1917-18	..	69·8	30·9
1918-19	..	67·0	20·3
1919-20	..	68·0	28·0
1920-21	71·1	67·6	23·3
1921-22	72·1	68·6	27·8
1922-23	72·8	69·2	28·5
1923-24	69·3	65·7	23·6
1924-25	70·8	67·1	25·3
1925-26	71·9	67·9	25·2
1926-27	69·4	65·9	24·1
1927-28	68·0	64·3	22·7
1928-29	72·0	68·2	26·6
1929-30	69·8	66·5	25·8
1930-31	71·1	67·4	26·5
1931-32	72·7	68·6	27·8
1932-33	71·0	67·0	25·4
1933-34	71·6	67·3	24·9
1934-35	70·7	66·7	24·8
1935-36	71·3	67·4	22·3
1936-37	73·0	69·0	26·8
1937-38	73·6	69·5	25·8
1938-39	..	69·9	22·9
1939-40	..	70·1	24·6
1940-41	..	68·8	21·0
1941-42	..	69·6	24·3
1942-43	..	70·4	23·0

Statement 2

Acreage and Production of WHEAT in India

1911-12	..	25·0	8·5
1912-13	..	23·9	8·2
1913-14	..	22·7	7·1
1914-15	..	25·5	8·7
1915-16	..	23·9	7·4
1916-17	..	25·1	8·4
1917-18	..	26·4	8·5
1918-19	..	19·2	6.5
1919-20	..	23·5	8.6
1920-21	25·1	20·4	5·7
1921-22	27·4	22·4	8·4
1922-23	29·9	24·4	8·2
1923-24	30·3	24·3	8·0
1924-25	30·5	24·8	7·2
1925-26	29·6	24·0	7·2
1926-27	30·0	24·2	7·4
1927-28	30·7	24·6	6·4
1928-29	30·8	24·9	7·3
1929-30	30·4	24·8	9·0
1930-31	30·7	24·7	7·7
1931-32	31·9	25·3	7·3
1932-33	31·3	24·9	7·0
1933-34	34·2	27·5	7·5
1934-35	32·7	25·6	7·8
1935-36	32·0	25·1	7·6
1936-37	31·9	25·2	7·9
1937-38	34·0	26·6	8·7
1938-39	..	26·8	8·0
1939-40	..	26·1	8·9
1940-41	..	26·4	8·1
1941-42	..	26·1	3·2
1942-43	..	25·9	9·0

Statement 3

Acreage and Production of BARLEY in India

Year	Area All-India	Area British India only	Production British India only
	(Million acres)	(Million acres)	(Million tons)
1911-12	..	8·5	..
1912-13	..	7·5	..
1913-14	..	7·2	..
1914-15	..	7·9	..
1915-16	..	8·0	3·7
1916-17	..	8·0	3·4
1917-18	..	8·5	3·4
1918-19	..	6·5	2·5
1919-20	..	7·6	3 3
1920-21	7·1	6·3	3·5
1921-22	5·4	7·4	3·2
1922-23	8·5	7·4	3·2
1923-24	8·5	7·2	3·0
1924-25	8·0	7·0	2·7
1925-26	7·6	6 7	2·6
1926-27	7·3	6·4	2·6
1927-28	7·0	6·0	2·1
1928-29	9·2	7·6	2·5
1929-30	8·1	7·1	2·3
1930 31	7·6	6·7	2·4
1931-32	7·3	6·5	2·4
1932-33	7·2	6·4	2·4
1933-34	7·6	6·7	2·5
1934-35	7·4	6·6	2·6
1935-36	7·0	6·2	2·4
1936-37	7·3	6·5	2·3
1937-38	7·1	6·3	2·1
1938-39	..	6·2	1·9
1939-40	..	6·1	2·0
1940-41	..	6·2	2·3
1941-42	..	6·5	2·0

Statement 4

Acreage and Production of *JOWAR* in India

1911-12	..	..	..	18·0	..
1912-13	..	..	..	20·6	..
1913-14	..	..	..	20·9	..
1914-15	..	..	..	20·7	..
1915-16	..	..	..	22·4	6·0
1916-17	..	..	..	21·2	5·0
1917-18	..	..	..	20·4	4·4
1918-19	..	..	..	20·0	3·4
1919-20	..	..	..	21·0	5·6
1920-21	..	..	36·7	22·0	3·6
1921-22	..	..	39·4	23·3	5·6
1922-23	..	..	37·6	21·9	5·0
1923-24	..	..	34·9	20·4	4·3
1924-25	..	..	36·4	21·7	4·8
1925-26	..	..	33·6	19·9	4·2
1926-27	..	..	34·1	20·4	4·2
1927-28	..	..	34·5	20·7	4·0
1928-29	..	..	34·3	20·0	4·7
1929-30	..	..	37·6	22·7	5·1
1930-31	..	..	37·7	22·3	5·0
1931-32	..	..	36·0	21·0	4·4
1932-33	..	..	35·6	20·8	4·5
1933-34	..	..	35·3	20·8	4·8
1934-35	..	..	35·3	21·2	4·6
1935-36	..	..	35·0	21·0	4·5
1936-37	..	..	38·3	23·5	4·6
1937-38	..	..	34·4	20·7	4·0
1938-39	..	..	..	20·8	4·1
1939-40	..	..	..	21·7	4·5
1940-41	..	..	..	21·2	4·6
1941-42	..	..	..	21·8	4·9
1942-43	..	..	..	..	..

Statement 5

Acreage and Production of *BAJRA* in India

Year	Area All-India	Area British India only	Production British India only
	(Million acres)	(Million acres)	(Million tons)
1911-12	..	12·8	..
1912-13	..	16 1	..
1913-14	..	15·2	..
1914-15	..	13·9	..
1915-16	..	14 3	.
1916-17	.	15·2	..
1917-18	..	12·7	.
1918-19	..	11·2	..
1919-20	..	14 6	2·8
1920-21	17·3	12·0	2·0
1921-22	23·3	15 9	2·6
1922-23	20·7	13·9	2·4
1923-24	20·0	13·7	2·2
1924-25	18·3	12·0	2·2
1925-26	18·8	12 3	2·0
1926-27	20·4	13·8	2·5
1927-28	20·1	14·1	2·4
1928-29	18·8	13·0	2·1
1929-30	19·6	13·3	2·0
1930-31	20·7	13·7	2·4
1931-32	20·9	13·9	2·2
1932-33	21·3	14·0	2·3
1933-34	20·3	13·1	2·1
1934-35	19·4	13·1	2·1
1935-36	19·7	13·1	2·3
1936-37	17·7	11·5	1·9
1937-38	18·7	12·5	1·9
1938-39	..	12·8	1·8
1939-40	..	13·4	2·0
1940-41	..	14·1	2·3
1941-42	..	14·2	2·2
1942-43	..	..	..

Statement 6

Acreage and Production of MAIZE in India

1911-12	..	5·4	..
1912-13	..	6·1	..
1913-14	..	6·0	..
1914-15	..	6·0	..
1915-16	..	6·5	..
1916-17	..	6·4	..
1917-18	..	6·3	..
1918-19	..	5·9	..
1919-20	..	6·5	2·6
1920-21	7·9	6·0	2·1
1921-22	8·4	6·1	2·4
1922-23	8·0	5·7	1·9
1923-24	7·7	5·7	2·2
1924-25	7·1	5·2	1.7
1925-26	7·1	5·3	1·8
1926-27	7·5	5·4	1·9
1927-28	7·8	5·7	2·2
1228-29	8·0	5·8	2·0
1929-30	8 6	6·3	2·4
1930-31	8·3	6·2	2·4
1931-32	8·1	5·9	2·2
1932-33	8·1	6·0	2·1
1933-34	8·0	5·8	1·9
1934-35	8·0	5·9	2·1
1935-36	8·0	6·0	2·1
1936-37	8·0	5·7	1·8
1937-38	7·9	5·6	2·0
1938-39	..	5·7	1·8
1939-40	..	5.8	2·1
1940-41	..	5·7	2·1
1941-42	..	5·6	1·9

Statement 7

Acreage and Production of GRAM in India

Year	Area All India (Million acres)	Area British India only (Million acres)	Production British India only (Million tons)
1911-12		11·1	
1912-13		12·3	
1913-14		9·7	
1914-15		11·3	
1915-16		13·5	
1916-17		15·5	
1917-18		16·	
1918-19		11·5	
1919-20		13·9	
1920-21	12·4	10·4	
1921-22	10·1	11·6	
1922-23	21·5	15·6	
1923-24	16·0	14·3	
1924-25	21·7	15·4	
1925-26	18·5	13·9	
1926-27	19·4	14·1	
1927-28	18·3	13·7	
1928-29	19·8	13·4	
1929-30	15·2	11·3	
1930-31	18·5	13·4	
1931-32	21·4	15·7	
1932-33	18·7	13·7	
1933-34	23·9	16·4	
1934-35	18·6	13·6	
1935-36	23·6	14·6	
1936-37	21·3	15·5	
1937-38	15·6	11·7	
1938-39		11·7	
1939-40		11·7	
1940-41		13·7	
1941-42		13·7	

Statement 8

Acreage of *RAGI*, MISCELLANEOUS FOOD CROPS and OTHER FOOD-GRAINS INCLUDING PULSES in India

Year	Area All-India (Million acres)	Area British India only (Million acres)
1911-12		
1912-13		
1913-14		
1914-15		
1915-16		
1916-17		
1917-18		
1918-19		
1919-20		
1920-21	41·6	
1921-22	45·1	
1922-23	41·6	
1923-24	44·2	
1924-25	44·1	
1925-26	41·1	
1926-27	45·9	
1927-28	45·7	
1928-29	45·6	
1929-30	46·7	
1930-31	47·1	
1931-32	47·8	
1932-33	47·9	
1933-34	47·8	
1934-35	47·0	
1935-36	46·9	
1936-37	46·4	
1937-38	42·9	
1938-39		
1939-40		
1940-41		

Statement 9

Acreage and Production of LINSEED in India

Year	Area All-India	Area British India only	Production British India only
	(Million acres)	(Million acres)	(Thousand tons)
1911-12	..	4·5	621
1912-13	..	3·8	558
1913-14	..	2·6	370
1914-15	..	3·1	394
1915-16	..	3·1	470
1916-17	..	3·2	502
1917-18	..	3·5	496
1918-19	..	1·7	209
1919 20	..	2·8	409
1920-21	2·4	1·9	266
1921-22	3·1	2·7	422
1922-23	3·6	3·1	510
1923-24	4·0	3·3	431
1924-25	3·9	3·2	461
1925-26	3·9	3·2	374
1926-27	3·5	3·0	384
1927-28	3·5	2·8	321
1928-29	3·3	2·6	304
1929-30	3·1	2·4	354
1930-31	3·2	2·6	348
1931-32	3·5	2·8	373
1932-33	3·4	2·8	369
1933-34	3·3	2·7	328
1934-35	3·5	2·7	342
1935-36	3·5	2·5	333
1936 37	3·8	2·9	356
1937-38	4·1	3·1	391
1938-39	..	3·1	377
1939-40	..	3·1	403
1940-41	..	2·9	366
1941-42	..	2·7	311
1942-43	..	2·7	349

Statement 10

Acreage and Production of SESAMUM in India

1911-12	..	3·9	351
1912-13	..	3·8	375
1913-14	..	3·9	317
1914-15	..	4·3	408
1915-16	..	4·0	396
1916-17	..	3·8	396
1917-18	..	3·1	315
1918-19	..	2·9	228
1919-20	..	3·3	384
1920-21	4·7	3·3	327
1921-22	5·1	3·6	417
1922-23	4·6	3·1	333
1923-24	4·5	3·1	332
1924 25	4·8	3·3	366
1925-26	4·3	2·9	309
1926-27	4·0	2·8	300
1927-28	4·6	3·2	362
1928-29	4·8	3·3	360
1929-30	4·5	3·2	329
1930-31	4·7	3·1	318
1931-32	4·6	3·2	357
1932-33	5·1	3·4	397
1933-34	5·0	3·5	377
1934-35	4·0	2·7	287
1935-36	4·5	3·0	315
1936-37	4·5	3·0	336
1937-38	5·0	3·4	358
1938-39	..	3·4	322
1939-40	..	3·2	338
1940-41	..	3·2	348
1941-42	..	3·2	326
1942-43	..	3·4	365

Statement 11

Acreage and Production of RAPE and MUSTARD in India

Year	Area All-India (Million acres)	Area British India only (Million acres)	Production British India only (Million tons)
1911-12	..	7·0	1·3
1912-13	..	5·9	1·2
1913-14	..	6·2	1·1
1914-15	..	6·4	1·2
1915-16	..	6·4	1·1
1916-17	..	6·4	1·2
1917-18	..	7·1	1·1
1918-19	..	4·9	0·8
1919-20	..	6·0	1·2
1920-21	5·1	5·0	0·9
1921-22	6·6	6·3	1·2
1922-23	6·7	6·2	1·2
1923-24	6·5	6·1	1·1
1924-25	6·5	6·4	1·2
1925-26	6·4	5·5	0·9
1926-27	6·7	5·5	1·0
1927-28	6·2	5·8	0·8
1928-29	7·4	6·9	0·9
1929-30	6·1	5·4	1·1
1930-31	6·4	6·4	1·0
1931-32	6·4	6·1	1·0
1932-33	6·2	5·9	1·0
1933-34	6·2	5·8	0·9
1934-35	6·4	5·2	0·9
1935-36	5·6	5·2	0·9
1936-37	6·2	5·7	0·9
1937-38	5·7	5·3	1·0
1938-39	..	5·1	0·7
1939-40	..	6·0	1·1
1940-41	..	6·1	1·1
1941-42	..	6·1	1·1
1942-43	..	6·7	1·1

Statement 12

Acreage and Production of GROUNDNUT in India

1911-12	..	..	..
1912-13	..	1·1	0·4
1913-14	..	1·4	0·6
1914-15	..	2·1	0·8
1915-16	..	1·8	0·9
1916-17	..	2·0	1·0
1917-18	..	1·3	0·9
1918-19	..	1·1	0·5
1919-20	..	1·3	0·7
1920-21	2·0	1·8	0·9
1921-22	2·0	1·7	0·8
1922-23	2·4	2·1	1·1
1923-24	2·6	2·2	0·9
1924-25	2·3	2·2	1·2
1925-26	2·7	2·2	1·0
1926-27	3··	2·3	1·3
1927-28	4·0	4·1	2·1
1928-29	3·1	4·1	2·4
1929-30	3·4	4·3	1·9
1930-31	3·7	4·6	2·3
1931-32	4·9	3·8	1·8
1932-33	5·4	4·9	2·4
1933-34	7·1	5·3	2·6
1934-35	4·7	3·4	1·4
1935-36	4·0	3·6	1·7
1936-37	5·2	4·5	2·2
1937-38	8·3	6·4	2·7
1938-39	..	5·7	2·1
1939-40	..	5·5	2·4
1940-41	..	6·0	2·7
1941-42	..	4·5	1·8
1942-43	..	4·8	1·8

Statement 13

Acreage of COCONUT in India

Year	Area All-India	Area British India only
	(Thousand acres)	(Thousand acres)
1920-21	1,189	614
1921-22	1,223	626
1922-23	1,229	623
1923-24	1,279	627
1924-25	1,245	602
1925-26	1,293	629
1926-27	1,341	626
1927-28	1,317	625
1928-29	1,371	640
1929-30	1,367	644
1930-31	1,385	630
1931-32	1,373	608
1932-33	1,426	629
1933-34	1,485	651
1934-35	1,455	655
1935-36	1,408	659
1936-37	1,403	656
1937-38	1,482	657
1938-39	..	659
1939-40	..	681
1940-41	..	*607

Statement 14

Acreage and Production of CASTOR SEED in India

Year	Area All-India	Area British India only	Production British India only
	(Thousand acres)	(Thousand acres)	(Thousand tons)
1920-21	1,316	501	..
1921-22	1,703	536	..
1922-23	1,633	476	..
1923-24	1,608	482	..
1924-25	1,637	510	..
1925-26	1,709	574	72
1926-27	1,443	570	57
1927-28	1,470	562	71
1928-29	1,354	527	59
1929-30	1,213	432	53
1930-31	1,460	451	50
1931-32	1,682	509	64
1932-33	1,618	542	68
1933-34	1,545	472	57
1934-35	1,436	417	43
1935-36	1,420	386	42
1936-37	1,447	413	48
1937-38	1,332	397	45
1938-39	..	411	43
1939-40	..	403	44
1940-41	..	398	48
1941-42	..	380	42
1942-43	..	413	46

Statement 15

Acreage of OTHER—OILSEEDS in India

Year	Area All-India	Area British India only
	(Thousand acres)	(Thousand acres)
1920-21	1,621	988
1921-22	1,517	955
1922-23	1,490	1,009
1923-24	1,501	993
1924-25	1,579	1,018
1925-26	1,701	1,138
1926-27	1,705	1,141
1927-28	1,795	1,182
1928-29	2,055	1,248
1929-30	1,866	1,182
1930-31	1,824	1,109
1931-32	1,957	1,081
1932-33	2,159	1,104
1933-34	2,008	1,125
1934-35	1,817	1,029
1935-36	2,463	1,572
1936-37	2,773	1,797
1937-38	2,839	1,690
1938-39	..	1,537
1939-10	..	1,495
1940-41	..	

Statement 16

Acreage of CONDIMENTS and SPICES in India

	(Million acres)	(Million acres)
1911-12	..	1·1
1912-13	..	1·3
1913-14	..	1·2
1914-15	..	1·2
1915-16	..	1·4
1916-17	..	1·5
1917-18	..	1·5
1918-19	..	1·3
1919-20	..	1·5
1920-21	1·7	1·2
1921-22	1·9	1·3
1922-23	1·9	1·4
1923-24	2·0	1·4
1924-25	1·9	1·3
1925-26	1·7	1·3
1926-27	1·6	1·3
1927-28	2·0	1·4
1928-29	2·0	1·4
1929-30	1·6	1·2
1930-31	1·7	1·3
1931-32	1·9	1·5
1932-33	1·9	1·5
1933-34	1·7	1·4
1934-35	2·3	1·7
1935-36	2·8	1·5
1936-37	2·5	1·3
1937-38	2·3	1·4
1938-39		1·3
1939-40		1·6
1940-41		1·5

Statement 17

Acreage and Production of SUGARCANE in India

Year	Area All-India	Area British India only	Production British India only
	(Million acres)	(Million acres)	(Million tons)
1911-12	..	2·4	2·4
1912-13	..	2·5	2·5
1913-14	..	2·5	2·3
1914-15	..	2·3	2·3
1915-16	..	2·4	2·5
1916-17	..	2·4	2·7
1917-18	..	2·8	3·3
1918-19	..	2·8	2·4
1919-20	..	2·6	2·9
1920-21	2·7	2·5	2·4
1921-22	2·5	2·3	2·5
1922-23	2·8	2·7	2·9
1923-24	3·0	2·9	3·2
1924-25	2·6	2·5	2·5
1925-26	2·8	2·6	2·9
1926-27	3·1	2·9	3·2
1927-28	3·1	2·9	3·1
1928-29	2·7	2·5	2·6
1929-30	2·6	2·4	2·7
1930-31	2·9	2·7	3·1
1931-32	3·1	2·9	3·8
1932-33	3·4	3·2	4·5
1933-34	3·4	3·2	4·7
1934-35	3·6	3·3	4·9
1935-36	4·1	3·8	6·6
1936-37	4·6	4·2	6·1
1937-38	4·0	3·7	5·1
1938-39	..	3·0	3·2
1939-40	..	3·5	4·3
1940-41	..	4·4	5·4
1941-42	..	3·3	4·0
1942-43	..	3·4	5·4

Statement 18

Acreage and Production of COTTON in India

				(Million acres)	(Thousand tons)
1911-12	..	..	..	14·4	418
1912-13	..	..	..	13·9	530
1913-14	..	..	..	15·5	602
1914-15	..	..	..	14·9	606
1915-16	..	..	..	11·2	451
1916-17	..	..	..	13·6	503
1917-18	..	..	..	15·2	443
1918-19	..	..	..	14·1	467
1919-20	..	..	..	14·9	703
1920-21	..	..	18·8	13·7	432
1921-22	..	..	16·3	11·3	493
1922-23	..	..	10·7	13·3	530
1923-24	..	..	21·9	15·1	581
1924-25	..	..	24·2	17·1	668
1925-26	..	..	25·1	17·7	666
1926-27	..	..	21·9	15·2	530
1927-28	..	..	21·2	14·5	614
1928-29	..	..	23·5	16·2	672
1929-30	..	..	22·4	15·8	643
1930-31	..	..	20·6	13·8	586
1931-32	..	..	20·9	14·3	444
1932-33	..	..	19·3	12·8	500
1933-34	..	..	21·1	14·1	586
1934-35	..	..	20·6	14·0	551
1935-36	..	..	22·5	15·2	674
1936-37	..	..	22·0	14·8	733
1937-38	..	..	22·8	15·4	603
1938-39	..	..	..	13·9	582
1939-40	..	..	..	13·3	601
1940-41	..	..	..	14·1	710
1941-42	..	..	..	14·8	746
1942-43	..	..	..	11·5	544

Statement 19

Acreage and Production of JUTE in India

Year	Area All-India	Area British India only	Production All-India	Production British India only
	(Million acres)	(Million acres)	(Million tons)	(Million tons)
1911-12 ..	3·1	3·1	1·5	1·5
1912-13 ..	3·4	3·3	2·0	2·0
1913-14 ..	3·2	3·1	1·7	1·7
1914-15 ..	3·4	3·3	1·9	1·8
1915-16 ..	2·4	2·3	1·3	1·3
1916-17 ..	2·7	2·7	1·5	1·5
1917-18 ..	2·7	2·7	1·6	1·6
1918-19 ..	2·5	2·5	1·2	1·2
1919-20 ..	2·8	2·8	1·5	1·5
1920-21 ..	2·5	2·5	1·1	1·0
1921-22 ..	1·5	1·5	0·7	0·7
1922-23 ..	1·5	1·4	0·8	0·8
1923-24 ..	2·4	2·3	1·3	1·3
1924-25 ..	2·8	2·7	1·4	1·4
1925-26 ..	3·0	2·9	1·5	1·5
1926-27 ..	3·7	3·6	2·1	2·0
1927-28 ..	3·4	3·3	1·8	1·8
1928-29 ..	3·1	3·1	1·8	1·8
1929-30 ..	3·3	3·3	1·8	1·8
1930-31 ..	3·5	3·5	2·0	2·0
1931-32 ..	1·9	1·8	1·0	1·0
1932-33 ..	1·9	1·9	1·1	1·1
1933-34 ..	2·5	2·5	1·4	1·4
1934-35 ..	2·5	2·5	1·4	1·4
1935-36 ..	2·0	1·9	1·1	1·1
1936-37 ..	2·6	2·5	1·6	1·6
1937-38 ..	2·8	2·9	1·5	1·5
1938 39 ..	3·2	3·1	1·2	1·2
1939-40 ..	3·2	3·1	1·7	1·7
1940-41 ..	4·4	4·3	1·8	1·8
1941-42 ..	..	2·1	..	1·0
1942-43 ..	..	3·3	..	1·9

Statement 20

Acreage under OTHER FIBRES in India

Year	Area All-India	Area British India only
	(Thousand acres)	(Thousand acres)
1911-12 ..	..	688
1912-13 ..	..	806
1913-14 ..	..	915
1914-15 ..	..	976
1915-16 ..	..	786
1916-17 ..	..	832
1917-18 ..	..	887
1918-19 ..	..	576
1919 20 ..	..	746
1920-21 ..	802	728
1921-22 ..	837	682
1922-23 ..	867	656
1923-24 ..	903	702
1924-25 ..	1,011	825
1925 26 ..	1,102	908
1926-27 ..	975	802
1927-28 ..	876	712
1928-29 ..	808	655
1929-30 ..	856	664
1930-31 ..	934	717
1931-32 ..	1,037	684
1932-33 ..	866	666
1933-34 ..	836	637
1934-35 ..	765	623
1935-36 ..	932	769
1936-37 ..	921	760
1937-38 ..	931	735
1938-39 ..	..	713
1939-40 ..	..	775
1940-41 ..	..	831
1941-42 ..	..	..
1942-43 ..	..	..

Statement 21

Acreage and Production of INDIGO in India

Year	Area All-India	Area British India only	Production British India only
	(Thousand acres)	(Thousand acres)	(Thousand cwt.)
1911-12	..	268	48
1912-13	..	224	41
1913-14	..	168	27
1914-15	..	145	25
1915-16	..	351	55
1916-17	..	764	94
1917-18	..	700	127
1918-19	..	285	47
1919-20	..	242	43
1920-21	290	210	43
1921-22	103	329	67
1922-23	311	276	51
1923-24	194	174	34
1924-25	128	106	20
1925-26	151	134	28
1926-27	108	103	19
1927-28	70	67	11
1928-29	84	81	16
1929-30	77	71	15
1930-31	70	64	13
1931-32	54	53	10
1932-33	61	59	11
1933-34	45	43	7
1934-35	59	59	10
1935-36	40	39	6
1936-37	44	42	7
1937-38	39	38	6
1938-39	..	40	6
1939-40	..	38	5
1940-41	..	65	11

Statement 22

Acreage and Production of COFFEE in India

	(Thousand acres)	(Thousand acres)	(Thousand tons)
1911-12	..	94	..
1912-13	..	92	..
1913-14	..	86	..
1914-15	..	86	..
1915-16	..	90	..
1916-17	..	91	..
1917-18	..	95	..
1918-19	..	98	..
1919-20	..	96	8
1920-21	204	95	9
1921-22	203	97	8
1922-23	203	97	11
1923-24	199	96	6
1924-25	198	94	11
1925-26	201	95	6
1926-27	202	91	10
1927-28	204	92	11
1928-29	201	87	6
1929-30	207	91	12
1930-31	193	92	8
1931-32	195	92	9
1932-33	198	93	8
1933-34	200	95	9
1934-35	206	96	8
1935-36	212	97	12
1936-37	214	98	9
1937-38	209	98	9
1938-39	..	96	11
1939-40	..	96	9
1940-41	..	96	..

Statement 23

Acreage and Production of TEA in India

Year	Area All-India	Area British India only	Production British India only
	(Thousand acres)	(Thousand acres)	(Thousand tons)
1911-12	..	512	113
1912-13	..	538	126
1913-14	..	572	130
1914-15	..	583	133
1915-16	..	592	157
1916-17	..	602	157
1917-18	..	617	166
1918-19	..	636	160
1919-20	..	652	158
1920-21	709	660	111
1921-22	710	661	111
1922-23	706	656	129
1923-24	709	659	155
1924-25	712	661	155
1925-26	720	675	149
1926-27	740	685	103
1927-28	748	688	101
1928-29	769	705	166
1929-30	780	711	179
1930 31	783	720	161
1931-32	795	719	182
1932-33	801	719	178
1933-34	804	724	156
1934-35	811	727	162
1935-36	816	731	160
1936-37	822	738	161
1937-38	824	730	175
1938-39	..	737	184
1939 40	..	737	183
1940-41	..	739	188

Statement 24

Acreage and Production of TOBACCO in India

1911-12	..	894	..
1912-13	..	869	..
1913-14	..	899	..
1914-15	..	961	..
1915-16	..	940	..
1916-17	..	947	..
1917-18	..	919	..
1918-19	.	930	..
1919-20	..	967	..
1920 21	1,039	823	..
1921-22	1,252	955	..
1922-23	1,213	911	..
1923-24	1,145	894	..
1924-25	1,170	935	..
1925-26	1,218	969	..
1926-27	1,152	939	..
1927-28	1,219	1,013	..
1928-29	1,224	1,020	453
1929-30	1,210	1,011	465
1930-31	1,178	987	421
1931-32	1,222	1,011	429
1932-33	1,191	1,015	435
1933-34	1,151	976	391
1934-35	1,335	1,137	471
1935-36	1,295	1,107	435
1936-37	1,225	1,018	441
1937-38	1,317	1,137	469
1938-39	..	1,166	464
1939-40	..	1,181	449
1940 41	..	1,126	423

Statement 25

Acreage under OPIUM, CINCHONA, INDIAN HEMP AND OTHER DRUGS AND NARCOTICS in India

Year	Area All-India	Area British India only
	(Thousand acres)	(Thousand acres)
1911-12	..	268
1912-13	..	277
1913-14	..	247
1914-15	..	276
1915-16	..	340
1916-17	..	405
1917-18	..	393
1918-19	..	362
1919-20	..	330
1920-21	..	312
1921-22	..	319
1922-23	..	322
1923-24	..	315
1924-25	..	304
1925-26	..	269
1926-27	..	237
1927-28	..	245
1928-29	..	226
1929-30	..	216
1930-31	..	226
1931-32	..	239
1932-33	..	225
1933-34	..	215
1934-35	..	205
1935-36	..	205
1936-37	..	205
1937-38	..	195
1938-39	..	200
1939-40	..	198
1940-41	..	208

Statement 26

Acreage under FODDER CROPS in India

	(Million acres)	(Million acres)
1911-12	..	4·9
1912-13	..	5·7
1913-14	..	5·9
1914-15	..	6·3
1915-16	..	*7·0
1916-17	..	8·1
1917-18	..	8·1
1918-19	..	7·0
1919-20	..	8·0
1920-21	10·0	7·9
1921-22	11·6	8·4
1922-23	11·4	8·5
1923-24	11·4	8·6
1924-25	11·6	8·6
1925-26	11·6	8·7
1926-27	12·3	8·7
1927-28	12·5	9·0
1928-29	12·4	9·0
1929-30	13·6	9·2
1930-31	13·0	9·1
1931-32	12·2	9·4
1932-33	12·9	9·7
1933-34	13·1	10·0
1934-35	13·3	10·1
1935-36	13·5	10.5
1936-37	13·7	10·6
1937-38	12·8	10·1
1938-39	..	10·4
1939-40	..	10·5
1940-41	..	10·5

*Increase in 1915-16 is due to inclusion of area under grass and *babul* in Bombay.

Statement 27

Acreage of FRUITS and VEGETABLES including ROOT CROPS in India

Year	Area All-India	Area British India only
	(Million acres)	(Million acres)
1913-14	..	4·7
1914-15	..	4·9
1915-16	..	4·6
1916-17	..	4·5
1917-18	..	4·3
1918-19	..	4·1
1919-20	..	4 4
1920-21	4·2	3·8
1921-22	4·1	4·0
1922-23	4·6	1·0
1923-24	4·3	3·9
1924-25	4 3	3·8
1925-26	4·5	3·9
1926-27	4·3	3·7
1927-28	4·2	3·7
1928-29	4·5	3·9
1929-30	5·0	4·0
1930-31	4·9	4·0
1931-32	4·5	3·8
1932-33	4·6	3·8
1933-34	4·4	3·7
1934-35	4·6	3·8
1935-36	4·7	3·7
1936-37	4·7	3·8
1937-38	4·6	3·8
1938-39	..	3·9
1939-40	..	4·0
1940-41	..	3·9

Statement 28

Total area and total production of all major food grains RICE, WHEAT, BARLEY, *JOWAR, BAJRA*, MAIZE and GRAM in India

Year	Area	Production	Population
	(Million acres)	(Million tons)	(Million persons)
1911-12	150·5	..	231·6
1912-13	155·0	..	..
1913-14	147·6	..	..
1914-15	157·3	..	..
1915-16	156·8	..	..
1916-17	161·7	..	..
1917-18	160·8	..	..
1918-19	137·4	..	..
1919-20	154·8	54·5	..
1920-21	143·6	41·6	..
1921-22	158·6	54·3	233·0
1922-23	159·2	54·3	..
1923-24	151·3	47·6	..
1924-25	154·1	48·0	..
1925-26	150·1	46·8	..
1926-27	150·4	46·6	..
1927-28	149·9	43·9	..
1928-29	152 9	47·8	..
1929-30	151·9	49·6	..
1930-31	154·5	49·6	..
1931-32	156·9	50·1	256·8
1932-33	153·0	47·7	..
1933-34	157·7	47·1	..
1934-35	152·7	47·3	..
1935-36	153·2	44·6	..
1936-37	157·0	49·2	..
1937-38	154·9	47·8	..
1938-39	153·9	43·3	..
1939-40	154·8	47·3	..
1940-41	155·4	43·6	..
1941-42	156·5	45·7	295·8

Statement 29

Acreage under FORESTS in India

Year	Area All-India	Area British India only
	(Million acres)	(Million acres)
1911-12	..	61·9
1912-13	..	63·1
1913-14	..	63·3
1914-15	..	63·2
1915-16	..	65·0
1916-17	..	64·7
1917-18	..	66·4
1918-19	..	67·0
1919-20	..	66·3
1920-21	83·9	66·4
1921-22	83·8	66·2
1922-23	83·8	66·2
1923-24	83·3	66·2
1924-25	83·9	66·8
1925-26	84·3	67·0
1926-27	84·0	66·9
1927-28	84·2	66·7
1928-29	84·0	66·8
1929-30	83·5	66·7
1930-31	83·8	66·7
1931 32	83·2	66·4
1932-33	83·4	66·6
1933-34	84·3	66·9
1934-35	85·2	67·0
1935-36	85·5	67·3
1936-37	85·7	67·2
1937-38	87·0	68·0
1938-39	..	68·2
1939-40	..	68·1
1940-41	..	68·3

Statement 30

Showing AREA NOT AVAILABLE FOR CULTIVATION in India

1911-12	..	104·3
1912-13	..	101·2
1913-14	..	101·6
1914-15	..	100·7
1915-16	..	99·8
1916-17	..	99·4
1917-18	..	98·0
1918-19	..	97·0
1919-20	..	97·8
1920-21	121·8	97·9
1921-22	121·0	97·8
1922-23	120·5	97·2
1923-24	121·0	97·1
1924-25	119·3	96·2
1925-26	118·9	95·7
1926-27	118·2	94·7
1927-28	119·5	95·6
1928-29	119·7	95·1
1929-30	118·6	93·1
1930-31	119·8	93·8
1931-32	120·1	93·6
1932-33	120·1	93·5
1933-34	119·7	92·6
1934-35	119·4	92·8
1935-36	119·7	92·9
1936-37	120·9	93·5
1937-38	119·0	92·4
1938-39	..	91·8
1939-40	..	89·3
1940-41	..	80·7

Statement 31

Acreage under CULTURABLE WASTE OTHER THAN FALLOW in India

Year	Area All-India	Area British India only
	(Million acres)	(Million acres)
1911-12	..	88·8
1912-13	..	89·5
1913-14	..	90·6
1914-15	..	89·9
1915-16	..	88·4
1916-17	..	87·2
1917-18	..	86·4
1918-19	..	88·8
1919-20	..	88·6
1920-21	108·4	90·2
1921-22	107·9	90·1
1922-23	108·1	93·1
1923-24	108·7	93·6
1924-25	108·5	92·5
1925-26	108·1	91·7
1926-27	109·7	92·7
1927-28	112·0	95·6
1928-29	110·9	94·9
1929-30	112·7	95·7
1930-31	111·2	94·2
1931-32	112·7	95·1
1932-33	112·1	91·8
1933-34	110·7	93·9
1934-35	112·3	94·6
1935-36	111·8	94·0
1936-37	110·6	92·2
1937-38	110·9	92·0
1938-39	..	94·2
1939-40	..	97·2
1940-41	..	97·9

Statement 32

Acreage under CURRENT FALLOWS in India

1911-12	..	49·7
1912-13	..	43·9
1913-14	..	47·9
1914-15	..	41·0
1915-16	..	46·6
1916-17	..	40·6
1917-18	..	43·5
1918-19	..	67·5
1919-20	..	47·1
1920-21	75·7	56·2
1921-22	59·2	46·6
1922-23	56·9	43·3
1923-24	59·4	45·7
1924-25	56·0	43·4
1925-26	59·0	45·5
1926-27	57·3	46·0
1927-28	59·1	47·0
1928-29	55·3	44·4
1929-30	58·0	45·8
1930-31	56·5	45·8
1931-32	56·6	44·8
1932-33	59·1	46·9
1933-34	55·4	43·8
1934-35	62·8	48·5
1935-36	59·2	47·1
1936-37	57·4	44·8
1937-38	58·6	45·4
1938-39	..	48·3
1939-40	..	47·3
1940-41	..	45·3

Statement 33

NET AREA SOWN in India

Year	Area All-India	Area British India only
	(Million acres)	(Million acres)
1911-12	..	202·6
1912-13	..	210·2
1913-14	..	204·9
1914-15	..	213·3
1915-16	..	207·6
1916-17	..	215·1
1917-18	..	213·0
1918-19	..	186·5
1919-20	..	207·6
1920-21	251·5	197·3
1921-22	269·8	207·2
1922-23	272·8	208·6
1923-24	270·2	206·2
1924-25	275·3	210·0
1925-26	272·6	208·6
1926-27	273·9	209·5
1927-28	271·2	206·5
1928-29	276·9	210·6
1929-30	276·6	210·4
1930-31	280·8	211·1
1931-32	280·8	211·4
1932-33	279·7	210·1
1933-34	284·8	214·0
1934-35	276·8	208·8
1935-36	279·3	209·7
1936-37	282·6	213·7
1937-38	280·9	213 5
1938-39	..	209·4
1939-40	..	210·0
1940-41	..	214·0

Statement 34

IRRIGATED AREA in India

1911-12	..	39·7
1912-13	..	44·4
1913-14	..	45·8
1914-15	..	46·1
1915-16	..	45·7
1916-17	..	46·7
1917-18	..	44·6
1918-19	..	46·0
1919-20	..	47·7
1920-21	55·8	47·8
1921-22	54·8	46·5
1922-23	55·1	46·5
1923-24	52·0	43·5
1924-25	52·8	43·8
1925-26	54·3	46·1
1926-27	54·6	46·3
1927-28	50·3	41·9
1928-29	57·4	48·3
1929-30	59·1	49·5
1930-31	57·9	48·2
1931-32	56·7	47·3
1932-33	58·2	48·5
1933-34	59·1	48·9
1934-35	58·9	49 0
1935-36	59·6	49·9
1936-37	60·2	50·2
1937-38	63·3	52·8
1938-39	..	53·7
1939-40	..	55·1
1940-41	..	55·8

Statement 35

Acreage and Production of RICE in Assam

Year	Area (Million acres)	Production (Million tons)
1911-12	4·3	2·0
1912-13	1·3	1·9
1913-14	1·5	1·4
1914-15	4·5	1·5
1915-16	1·4	1·3
1916-17	1·5	1·5
1917-18	1·6	1·9
1918-19	4·1	1·3
1919-20	4·3	1·5
1920-21	4·1	1·5
1921-22	4·3	1·3
1922-23	1·4	1·5
1923-24	4·6	1·5
1924-25	4·5	1·5
1925-26	1·4	1·6
1926-27	4·5	1·5
1927-28	4·2	1·3
1928-29	4·7	1·7
1929-30	4·1	1·3
1930-31	4·5	1·4
1931-32	1·6	1·6
1932-33	4·7	1·7
1933-34	4·7	1·4
1934-35	4·8	1·5
1935-36	5·3	1·6
1936-37	5·4	1·9
1937-38	5·1	1·7
1938-39	5·4	1·7
1939-40	5·4	1·7
1940-41	5·4	1·8
1941-42	5·0	1·5
1942-43	5·1	1·6

Statement 36

Acreage and Production of RICE in Bengal

1911-12	21·0	8·0
1912-13	21·2	8·6
1913-14	19·7	7·4
1914-15	20·5	6·4
1915-16	20·9	8·3
1916-17	21·1	8·0
1917-18	21·0	8·6
1918-19	21·3	6·9
1919-20	20·9	8·3
1920-21	20·9	8·2
1921-22	21·8	9·3
1922-23	21·8	9·0
1923-24	20·3	7·5
1924-25	20·9	7·7
1925-26	21·1	8·2
1926-27	19·7	7·3
1927-28	18·7	6·5
1928-29	21·4	9·7
1929-30	20·2	8·2
1930-31	20·6	9·2
1931-32	22·1	9·5
1932-33	21·8	9·4
1933-34	21·7	8·7
1934-35	20·7	8·3
1935-36	21·1	7·2
1936-37	22·0	9·8
1937-38	22·2	9·0
1938-39	22·0	7·6
1939-40	22·3	8·5
1940-41	20·8	6·0
1941-42	23·8	9·8
1942-43	23·1	6·0

Statement . 37

Acreage and Production of RICE in Bihar and Orissa

Year	Area	Production
	(Million acres)	(Million tons)
1911-12	17·4	8·9
1912-13	16·1	5·9
1913-14	16·2	8·1
1914-15	15·9	5·9
1915-16	16·1	8·7
1916-17	16·4	8·9
1917-18	15·6	8·9
1918-19	15·1	4·8
1919-20	15·3	7·0
1920-21	14·9	4·8
1921-22	15·2	6·4
1922-23	15·4	7·3
1923-24	14·0	4·9
1924-25	14·5	6·0
1925-26	14·1	4·8
1926-27	14·0	4·8
1927-28	13·5	4·4
1928-29	14·4	5·6
1929-30	14·2	6·0
1930-31	13·9	5·6
1931-32	14·1	5·7
1932-33	13·1	4·2
1933-34	13·2	4·3
1934-35	13·7	4·7
1935-36	14·7	3·7
1936-37	15·1	5·0
1937-38	14·7	4·7
1938-39	14·7	4·1
1939-40	14·7	4·6
1940-41	14·3	3·5
1941-42	13·9	4·1
1942-43	14·3	4·5

Statement 38

Acreage and Production of RICE in the Central Provinces and Berar

1911-12	4·8	1·4
1912-13	5·0	1·2
1913-14	5·0	0·8
1914-15	4·9	1·0
1915-16	5·1	1·7
1916-17	5·1	1·5
1917-18	5·2	1·6
1918-19	5·3	0·7
1919-20	5·1	1·7
1920-21	5·1	0·7
1921-22	5·1	1·5
1922-23	5·1	1·5
1923-24	5·2	1·6
1924-25	5·2	1·2
1925-26	5·2	1·4
1926-27	5·3	1·6
1927-28	5·4	1·6
1928-29	5·4	1·5
1929-30	5·5	1·8
1930-31	5·5	1·4
1931-32	5·5	1·8
1932-33	5·6	1·7
1933-34	5·6	1·7
1934-35	5·6	1·8
1935-36	5·6*	1·5*
1936-37	5·7	1·8
1937-38	5·8	1·6
1938-39	5·8	1·7
1939-40	5·9	1·5
1940-41	5·9	1·1
1941-42	5·8	0·9
1942-43	5·8	1·9

*Excluding statistics for the portion of the Raipur and Bilaspur districts transferred to the Orissa Province.

Statement 39

Acreage and Production of RICE in Madras

Year	Area	Production
	(Million acres)	(Million tons)
1911-12	10·3	3·9
1912-13	10·9	4·4
1913-14	10·7	4·2
1914-15	10 9	4·2
1915-16	11·2	4·6
1916-17	11·5	6·0
1917-18	11·7	5·5
1918-19	10·5	4·2
1919-20	11·6	5·4
1920-21	11·1	6 0
1921-22	11·3	5·2
1922-23	11·3	5·2
1923 24	10·5	4·5
1924-25	10·9	4·9
1925-26	11·3	5·2
1926-27	10·8	4·1
1927-28	10·9	5 1
1928-29	11 0	5·2
1929-30	11·3	5·3
1930-31	11·7	5·4
1931-32	11·5	5·4
1932-33	11·5	5·4
1933-34	11·7	5·3
1934-35	11·1	5·0
1935-36	*9·8	*4·7
1936-37	9·9	4·8
1937-38	10·1	4·9
1938-39	9·8	4·1
1939-40	9·9	4·5
1940-41	10·7	5·2
1941-42	10·2	5·0
1942-43	10·4	4·6

*Excluding statistics for portions of Ganjam and Vizagapatam districts transferred to the Orissa Province.

Statement 40

Acreage and Production of RICE in the United Provinces

1911-12	5·4	1·8
1912-13	6·9	2·0
1913-14	6·3	1·3
1914-15	6·3	2·1
1915-16	6·5	2·3
1916-17	7·2	2·7
1917-18	7·5	2·7
1918-19	6·8	1·5
1919-20	6·7	2·3
1920-21	6·9	1·6
1921-22	6·9	2·3
1922-23	7·1	2·1
1923-24	7·1	2·0
1924-25	7·2	2·3
1925-26	7·5	2·2
1926-27	7·6	2·4
1927-28	7·4	2·2
1928 29	7·1	1·1
1929-30	6·9	1·6
1930-31	6·8	1 7
1931-32	6·7	2·0
1932-33	6·3	1·4
1933-34	6·1	1 8
1934-35	6·6	2·0
1935-36	6·7	2·0
1936-37	6·8	2·0
1937-38	7·2	2·1
1938-39	7·8	2·1
1939-40	7·8	2·4
1940-41	7·3	1·8
1941-42	6·6	1·6
1942-43	7·0	1·8

Statement 41

Acreage and Production of WHEAT in Bihar and Orissa

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,285	557
1912-13	1,177	490
1913-14	1,342	583
1914-15	1,254	357
1915-16	1,330	581
1916-17	1,308	598
1917-18	1,199	497
1918-19	980	366
1919-20	1,145	498
1920-21	1,097	456
1921-22	1,134	546
1922-23	1,266	518
1923-24	1,226	466
1924-25	1,173	473
1925-26	1,162	427
1926-27	1,186	477
1927-28	1,198	418
1928-29	1,212	513
1929-30	1,200	515
1930-31	1,213	454
1931-32	1,221	560
1932-33	1,235	492
1933-34	1,222	476
1934-35	1,197	505
1935-36	1,145	417
1936-37	1,132	436
1937-38	1,102	434
1938-39	1,097	386
1939-40	1,142	425
1940-41	1,100	406
1941-42	1,304	486
1942-43	1,284	582

Statement 42

Acreage and Production of WHEAT in Bombay (including Sind)

	(Million acres)	(Thousand tons)
1911-12	1·4	295
1912-13	1·7	540
1913-14	1·9	475
1914-15	2·2	676
1915-16	2·3	615
1916-17	2·3	636
1917-18	2·7	709
1918-19	1·1	243
1919-20	2·0	479
1920-21	1·5	236
1921-22	1·9	401
1922-23	2·0	416
1923-24	1·6	261
1924-25	2·0	378
1925-26	1·5	284
1926-27	1·8	318
1927-28	1·9	395
1928-29	2·1	406
1929-30	2·1	430
1930-31	2·3	441
1931-32	2·3	444
1932-33	2·6	602
1933-34	3·2	631
1934-35	2·8	559
1935-36	2·8	607
1936-37	2·6	600
1937-38	3·0	674
1938-39	3·0	702
1939-40	3·0	638
1940-41	3·0	632
1941-42	2·8	613
1942-43	2·7	656

Statement 43

Acreage and Production of WHEAT in the Central Provinces and Berar

Year	Area	Production
	(Million acres)	(Thousand tons).
1911-12	3·6	870
1912-13	3·6	1,025
1913-14	3·3	657
1914-15	3·3	752
1915-16	3·5	930
1916-17	3·8	1,124
1917-18	3·0	755
1918-19	2·8	663
1919-20	3·2	849
1920-21	2·6	352
1921-22	2·4	708
1922-23	3·0	1,028
1923-24	3·3	814
1924-25	3·3	1,060
1925-26	3·6	881
1926-27	3·7	773
1927-28	3·7	691
1928-29	3·2	515
1929-30	3·0	588
1930-31	3·1	635
1931-32	3·6	673
1932-33	3·5	665
1933-34	3·4	716
1934-35	3·6	763
1935-36	3·4	641
1936-37	3·1	600
1937-38	3·4	673
1938-39	3·4	672
1939-40	3·2	614
1940-41	3·2	572
1941-42	2·9	390
1942-43	2·5	510

Statement 44

Acreage and Production of WHEAT in the Punjab

	(Million acres)	(Million tons).
1911-12	9·7	3·4
1912-13	8·8	2·9
1913-14	8·5	2·8
1914-15	9·9	3·4
1915-16	9·0	2·2
1916-17	9·5	2·6
1917-18	9·9	3·2
1918-19	7·7	2·6
1919-20	8·8	3·4
1920-21	7·8	2·0
1921-22	8·8	3·6
1922-23	9·6	3·2
1923-24	9·7	3·5
1924-25	9·7	3·6
1925-26	9·5	2·9
1926-27	9·4	2·9
1927-28	9·0	2·3
1928-29	10·0	3·1
1929-30	10·0	3·8
1930-31	9·3	3·1
1931-32	9·1	2·8
1932-33	8·6	2·8
1933-34	9·8	2·8
1934-35	9·0	3·0
1935-36	9·3	3·1
1936-37	9·4	3·4
1937-38	9·9	3·7
1938-39	9·5	3·2
1939-40	9·6	3·8
1940-41	9·9	3·3
1941-42	10·0	3·9
1942-43	10·4	4·2

Statement 45

Acreage and Production of WHEAT in the United Provinces

Year	Area	Production
	(Million acres)	(Million tons)
1911-12	7·7	3·1
1912-13	7·5	3·0
1913-14	6·5	2·3
1914-15	7·4	3·1
1915-16	6·7	2·8
1916-17	6·9	3·1
1917-18	7·4	2·9
1918-19	5·6	2·4
1919-20	7·2	3·1
1920-21	6·6	2·4
1921-22	7·0	2·7
1922-23	7·1	2·6
1923-24	7·3	2·7
1924-25	7·6	2·6
1925-26	7·0	2·3
1926-27	6·9	2·5
1927-28	7·6	2·4
1928-29	7·3	2·5
1929-30	7·3	3·4
1930-31	7·8	2·7
1931-32	7·9	2·7
1932-33	7·8	2·8
1933-34	8·0	2·6
1934-35	7·7	2·6
1935-36	7·2	2·6
1936-37	7·6	2·5
1937-38	8·0	2·8
1938-39	8·5	2·7
1939-40	8·1	3·2
1940-41	7·9	2·8
1941-42	7·9	2·6
1942-43	7·6	2·7

Statement 46

Acreage and Production of BARLEY in Bihar and Orissa

	(Thousand acres)	(Thousand tons)
1911-12	1,340	579
1912-13	1,332	552
1913-14	1,305	557
1914-15	1,303	431
1915-16	1,314	482
1916-17	1,271	552
1917-18	1,337	502
1918-19	1,237	440
1919-20	1,354	534
1920-21	1,322	522
1921-22	1,373	613
1922-23	1,406	500
1923-24	1,201	505
1924-25	1,330	531
1925-26	1,322	512
1926-27	1,284	507
1927-28	1,293	460
1928-29	1,294	490
1929-30	1,350	517
1930-31	1,362	533
1931-32	1,356	514
1932-33	1,526	560
1933-34	1,307	460
1934-35	1,473	570
1935-36	1,275	368
1936-37	1,272	432
1937-38	1,301	462
1938-39	1,294	419
1939-40	1,205	405
1940-41	1,298	446
1941-42	1,284	446
1942-43	..	..

Statement 47

Acreage and Production of BARLEY in the Punjab

Year	Acreage	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,339	382
1912-13	1,007	260
1913-14	970	288
1914-15	1,308	377
1915-16	1,040	228
1916-17	1,153	286
1917-18	1,475	424
1918-19	865	333
1919-20	1,204	376
1920-21	631	103
1921-22	1,112	297
1922-23	1,173	365
1923-24	1,246	410
1924-25	936	253
1925-26	804	218
1926-27	767	234
1927-28	835	217
1928-29	1,340	267
1929-30	921	203
1930-31	656	161
1931-32	629	161
1932-33	618	150
1933-34	709	148
1934-35	612	168
1935-36	666	175
1936-37	740	206
1937-38	777	206
1938-39	575	151
1939-40	730	260
1940-41	799	219
1941-42	804	227
1942-43	900	273

Statement 48

Acreage and Production of BARLEY in the United Provinces

	(Million acres)	(Million tons)
1911-12	5·3	..
1912-13	4·7	..
1913-14	4·5	1·7
1914-15	4·7	2·1
1915-16	5·1	2·3
1916-17	5·1	2·4
1917-18	5·2	2·3
1918-19	3·9	1·9
1919-20	4·5	2·2
1920-21	4·0	1·8
1921-22	4·4	2·1
1922-23	4·4	2·1
1923-24	4·3	2·0
1924-25	4·4	1·8
1925-26	4·1	1·8
1926-27	4·0	1·7
1927-28	4·4	1·8
1928-29	4·5	1·6
1929-30	4·4	1·4
1930-31	4·3	1·6
1931-32	4·1	1·6
1932-33	3·9	1·6
1933-34	4·4	1·7
1934-35	4·2	1·7
1935-36	3·9	1·7
1936-37	4·1	1·6
1937-38	3·8	1·8
1938-39	4·0	1·2
1939-40	3·8	1·2
1940-41	3·9	1·5
1941-42	4·0	1·2
1942-43	4·2	1·6

Statement 49

Acreage and Production of *JOWAR* in Bombay (including Sind)

Year	Area	Production
	(Million acres)	(Thousand tons)
1911-12	6·5	1,044
1912-13	7·7	1,661
1913-14	7·5	1,019
1914-15	7·3	1,945
1915-16	8·1	2,227
1916-17	8·1	2,009
1917-18	8·7	1,788
1918-19	7·7	1,083
1919-20	8·4	1,994
1920-21	8·8	1,210
1921-22	8·6	1,737
1922-23	8·7	1,691
1923-24	7·9	1,243
1924-25	9·2	1,835
1925-26	8·3	1,566
1926-27	8·0	1,473
1927-28	7·8	1,831
1928-29	7·8	1,756
1929-30	9·4	1,752
1930-31	9·2	1,912
1931-32	7·9	1,665
1932-33	8·2	1,730
1933-34	8·3	1,634
1934-35	8·4	1,767
1935-36	8·3	1,665
1936-37	10·3	1,696
1937-38	8·5	1,316
1938-39	8·2	1,421
1939-40	8·5	1,328
1940-41	8·6	1,523
1941-42	9·0	1,287
1942-43	8·0	1,169

Statement 50

Acreage and Production of *JOWAR* in the Central Provinces and Berar

	(Million acres)	(Thousand tons)
1911-12	4·0	986
1912-13	4·0	980
1913-14	3·9	918
1914-15	4·3	1,274
1915-16	5·0	1,645
1916-17	4·2	881
1917-18	3·8	747
1918-19	4·7	654
1919-20	4·4	1,243
1920-21	4·5	501
1921-22	5·0	1,444
1922-23	4·5	1,211
1923-24	4·1	1,000
1924-25	4·2	957
1925-26	3·8	763
1926-27	4·2	888
1927-28	4·3	994
1928-29	4·2	1,109
1929-30	4·3	1,036
1930-31	4·7	1,181
1931-32	4·3	783
1932-33	4·3	944
1933-34	4·3	1,025
1934-35	4·3	962
1935-36	4·2	845
1936-37	4·7	1,015
1937-38	4·2	1,061
1938-39	4·3	929
1939-40	4·8	1,162
1940-41	4·5	1,085
1941-42	4·8	976
1942-43	5·4	1,149

Appendix III

Acreage and Production of JOWAR in Madras

Year	Area (Unit: acres)	Production (Unit: thousand tons)
1911-12		
1912-13		
1913-14		
1914-15		
1915-16		
1916-17		
1917-18		
1918-19		
1919-20		
1920-21		
1921-22		
1922-23		
1923-24		
1924-25		
1925-26		
1926-27		
1927-28		
1928-29		
1929-30		
1930-31		
1931-32		
1932-33		
1933-34		
1934-35		
1935-36		
1936-37		
1937-38		
1938-39		
1939-40		
1940-41		
1941-42		
1942-43		
1943-44		

Statement 3.53

Area and Production of BAJRA in the Punjab

Year	Area (Unit: acres)	Production (Unit: tons)
1911-12		
1912-13		
1913-14		
1914-15		
1915-16		
1916-17		
1917-18		
1918-19		
1919-20		
1920-21		
1921-22		
1922-23		
1923-24		
1924-25		
1925-26		
1926-27		
1927-28		
1928-29		
1929-30		
1930-31		
1931-32		
1932-33		
1933-34		
1934-35		
1935-36		
1936-37		
1937-38		
1938-39		
1939-40		
1940-41		
1941-42		
1942-43		
1943-44		

Statement 53

Acreage and Production of *JOWAR* in the United Provinces

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,633	356
1912-13	2,169	598
1913-14	2,063	227
1914-15	2,413	630
1915-16	2,547	605
1916-17	2,402	523
1917-18	1,982	372
1918-19	1,852	198
1919-20	2,330	502
1920-21	2,313	351
1921-22	2,684	647
1922-23	2,270	486
1923-24	2,470	598
1924-25	2,047	411
1925-26	1,990	400
1926-27	2,301	524
1927-28	2,146	557
1928-29	2,264	334
1929-30	2,460	643
1930-31	2,500	538
1931-32	2,610	526
1932-33	2,381	497
1933-34	2,632	493
1934-35	2,241	460
1935-36	2,237	440
1936-37	2,122	426
1937-38	2,232	436
1938-39	2,245	421
1939-40	2,307	531
1940-41	2,221	518
1941-42	2,120	388
1942-43	..	656

Statement 54

Acreage and Production of *BAJRA* in Bombay (including Sind)

	(Million acres)	(Thousand tons)
1911-12	5·1	470
1912-13	6·0	850
1913-14	6·4	883
1914-15	6·3	919
1915-16	5·5	820
1916-17	5·7	906
1917-18	4·2	445
1918-19	3·3	266
1919-20	5·5	818
1920-21	3·8	497
1921-22	6·1	756
1922-23	4·0	613
1923-24	5·4	619
1924-25	4·1	609
1925-26	4·7	543
1926-27	5·7	791
1927-28	5·7	760
1928-29	5·0	707
1929-30	4·4	504
1930-31	5·1	659
1931-32	5·2	569
1932-33	5·1	621
1933-34	4·6	574
1934-35	4·8	583
1935-36	4·7	637
1936-37	3·4	370
1937-38	4·9	598
1938-39	5·0	611
1939-40	4·7	533
1940-41	4·8	579
1941-42	4·6	501
1942-43	5·8	772

Statement 55

Acreage and Production of *BAJRA* in Madras

Year	Area	Production
	(Million acres)	(Thousand tons)
1911-12	3·4	..
1912-13	3·6	551
1913-14	3·3	535
1914-15	3·5	608
1915-16	3·7	748
1916-17	3·4	026
1917-18	3·3	808
1918-19	2·0	701
1919-20	3·3	850
1920-21	3·0	814
1921-22	3·2	825
1922-23	3·1	816
1923-24	2·6	632
1924-25	3·0	837
1925-26	3·1	819
1926-27	3·1	787
1927-28	3·3	836
1928-29	3·1	829
1929-30	2·9	701
1930-31	2·9	775
1931-32	2·9	780
1932-33	2·8	784
1933-34	2·6	691
1934-35	2·7	627
1935-36	2·7	716
1936-37	2·8	709
1937-38	2·6	661
1938-39	2·7	613
1939-40	2·8	703
1940-41	2·6	713
1941-42	2·5	640
1942-43	2·6	662

Statement 56

Acreage and Production of *BAJRA* in the Punjab

	(Thousand acres)	(Thousand tons)
1911-12	1,185	97
1912-13	2,677	316
1913-14	2,820	302
1914-15	2,739	346
1915-16	1,609	150
1916-17	3,033	514
1917-18	2,543	312
1918-19	1,562	105
1919-20	2,675	446
1920-21	2,422	199
1921-22	3,321	391
1922-23	3,119	424
1923-24	2,850	395
1924-25	2,595	362
1925-26	2,563	278
1926-27	2,692	363
1927-28	2,718	333
1928-29	2,480	247
1929-30	2,365	282
1930-31	3,236	434
1931-32	3,233	460
1932-33	3,403	326
1933-34	3,356	377
1934-35	3,043	355
1935-36	3,018	390
1936-37	2,851	361
1937-38	2,016	239
1938-39	2,641	218
1939-40	3,091	244
1940-41	3,863	477
1941-42	3,705	443
1942-43	4,135	644

Statement 57

Acreage and Production of *BAJRA* in the United Provinces

Year	Area	Production
	(Million acres)	(Thousand tons)
1911-12	2·9	601
1912-13	2·6	611
1913-14	2·2	260
1914-15	2·8	612
1915-16	2·8	620
1916-17	2·5	469
1917-18	2·2	407
1918-19	3·0	293
1919-20	2·7	629
1920-21	2·4	395
1921-22	2·7	556
1922-23	2·3	461
1923-24	2·3	458
1924-25	1·8	330
1925-26	1 6	271
1926-27	1·9	445
1927-28	1·9	401
1928-29	2·0	206
1929-30	2·1	366
1930-31	2·0	398
1931-32	2·2	343
1932-33	2·2	429
1933-34	2·1	379
1934-35	2·2	451
1935-36	2·3	157
1936-37	2·0	372
1937-38	2·1	323
1938-39	2·1	308
939-40	2·4	464
1940-41	2·4	451
1941-42	3·0	481
1942-43	..	646

Statement 58

Acreage and Production of MAIZE in Bihar and Orissa

	(Thousand acres)	(Thousand tons)
1911-12	1,661	549
1912-13	1,772	553
1913-14	1,714	541
1914-15	1,515	401
1915-16	1,679	487
1916-17	1,682	523
1917-18	1,684	618
1918-19	1,706	487
1919-20	1,773	620
1920-21	1,764	635
1921-22	1,800	727
1922-23	1,639	349
1923-24	1,680	487
1924-25	1,594	263
1925-26	1,676	505
1926-27	1,648	447
1927-28	1,648	514
1928-29	1,625	417
1929-30	1,719	591
1930-31	1,630	521
1931-32	1,094	523
1932-33	1,821	562
1933-34	1,697	449
1934-35	1,654	468
1935-36	1,725	507
1936-37	1,673	489
1937-38	1,584	452
1938-39	1,552	360
1939-40	1,513	450
1940-41	1,438	400
1941-42	1,489	462
1942-43	1,681	565

Statement 59

Acreage and Production of MAIZE in the North-West Frontier Province

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	410	184
1912-13	419	188
1913-14	431	228
1914-15	419	203
1915-16	431	237
1916-17	451	219
1917-18	463	249
1918-19	450	206
1919-20	454	123
1920-21	418	162
1921-22	462	217
1922-23	460	220
1923-24	438	226
1924-25	420	218
1925-26	435	200
1926-27	437	171
1927-28	482	226
1928-29	463	212
1929-30	481	220
1930-31	470	224
1931-32	449	211
1932-33	449	193
1933-34	465	189
1934-35	475	213
1935-36	472	188
1936-37	457	214
1937-38	471	220
1938-39	486	214
1939-40	465	230
1940-41	471	211
1941-42	469	202
1942-43	482	..

Statement 60

Acreage and Production of MAIZE in the Punjab

	(Thousand acres)	(Thousand tons)
1911-12	955	366
1912-13	1,098	413
1913-14	1,082	441
1914-15	1,047	283
1915-16	1,184	464
1916-17	1,270	461
1917-18	1,219	319
1918-19	1,151	399
1919-20	1,156	496
1920-21	1,063	316
1921-22	1,112	380
1922-23	1,123	391
1923-24	1,050	369
1924-25	922	336
1925-26	931	311
1926-27	975	346
1927-28	1,085	425
1928-29	1,048	347
1929-30	1,142	397
1930-31	1,095	412
1931-32	1,004	380
1932-33	1,034	348
1933-34	1,056	288
1934-35	1,136	412
1935-36	1,091	382
1936-37	1,078	392
1937-38	1,103	406
1938-39	1,110	384
1939-40	1,143	405
1940-41	1,144	448
1941-42	1,188	468
1942-43	1,271	443

Statement 61

Acreage and Production of MAIZE in the United Provinces

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,804	708
1912-13	2,218	925
1913-14	2,149	725
1914-15	2,389	1,056
1915-16	2,631	1,162
1916-17	2,430	955
1917-18	2,335	1,032
1918-19	1,895	512
1919-20	2,444	1,020
1920-21	2,108	633
1921-22	2,088	820
1922-23	1,880	602
1923-24	1,848	771
1924-25	1,564	535
1925-26	1,626	559
1926-27	1,692	667
1927-28	1,875	782
1928-29	2,017	893
1929-30	2,341	919
1930-31	2,384	937
1931-32	2,125	837
1932-33	2,147	755
1933-34	2,033	698
1934-35	2,131	800
1935-36	2,130	812
1936-37	1,971	536
1937-38	1,957	733
1938-39	2,003	610
1939-40	2,107	840
1940-41	2,120	814
1941-42	1,020	504
1942-43	2,407	941

Statement 62

Acreage and Production of GRAM in Bihar and Orissa

	(Thousand acres)	(Thousand tons
1911-12	902	411
1912-13	1,287	608
1913-14	1,079	447
1914-15	1,361	403
1915-16	1,402	526
1916-17	1,397	607
1917-18	1,556	584
1918-19	1,031	366
1919-20	1,515	598
1920-21	1,408	556
1921-22	1,481	649
1922-23	1,512	670
1923-24	1,427	541
1924-25	1,437	509
1925-26	1,412	520
1926-27	1,422	561
1927-28	1,326	430
1928-29	1,288	442
1929-30	1,467	533
1930-31	1,482	532
1931-32	1,465	503
1932-33	1,499	503
1933-34	1,484	492
1934-35	1,457	495
1935-36	1,355	386
1936-37	1,380	462
1937-38	1,371	455
1938-39	1,356	418
1939-40	1,463	492
1940-41	1,457	471
1941-42	1,457	533

Statement 63

Acreage and Production of GRAM in the Central Provinces and Berar

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,110	244
1912-13	1,116	280
1913-14	1,140	190
1914-15	1,161	247
1915-16	1,045	238
1916-17	1,152	266
1917-18	1,140	216
1918-19	933	187
1919-20	1,047	209
1920-21	899	129
1921-22	899	103
1922-23	1,104	220
1923-24	1,188	282
1924-25	1,120	274
1925-26	1,277	285
1926-27	1,140	225
1927-28	1,104	178
1928-29	1,208	152
1929-30	1,214	219
1930-31	1,332	226
1931-32	1,327	250
1932-33	1,365	250
1933-34	1,210	202
1934-35	1,238	254
1935-36	1,217	231
1936-37	1,154	209
1937-38	1,191	223
1938-39	1,107	185
1939-40	1,012	196
1940-41	1,152	197
1941-42	1,116	157
1942-43	1,003	168

Statement 64

Acreage and Production of GRAM in the Punjab

	(Million acres)	(Thousand tons)
1911-12	4·1	1,126
1912-13	3·4	735
1913-14	2·8	578
1914-15	5·2	1,289
1915-16	3·7	454
1916-17	5·1	856
1917-18	6·0	1,509
1918-19	2·0	405
1919-20	4·1	1,009
1920-21	2·2	361
1921-22	5·1	1,143
1922-23	5·4	1,510
1923-24	4·2	1,116
1924-25	5·7	1,149
1925-26	3·7	760
1926-27	4·7	1,198
1927-28	4·1	858
1928-29	4·2	726
1929-30	3·2	763
1930-31	4·1	910
1931-32	5·5	1,080
1932-33	3·9	894
1933-34	6·6	1,385
1934-35	3·6	798
1935-36	4·7	954
1936-37	4·9	953
1937-38	3·8	640
1938-39	2·3	375
1939-40	2·4	499
1940-41	3·6	700
1941-42	3·6	649
1942-43	4·7	1,074

Statement 65

Acreage and Production of GRAM in the United Provinces

Year	Area	Production
	(Million acres)	(Million tons)
1911-12	6·9	2·5
1912-13	5·5	1·8
1913-14	3·0	0·6
1914-15	5·3	1·8
1915-16	6·1	2·0
1916-17	6·5	2·3
1917-18	6·4	1·9
1918-19	2·7	0·8
1919-20	4·9	1·6
1920-21	1·0	1·2
1921-22	6·1	2·1
1922-23	7·1	2·5
1923-24	6·4	2·3
1924-25	6·8	2·0
1925-26	6·6	2·1
1926-27	6·0	1·8
1927-28	5·9	1·5
1928-29	6·4	1·1
1929-30	4·2	1·2
1930-31	5·1	1·4
1931-32	5·7	1·6
1932-33	5·4	1·4
1933-34	5·3	1·3
1934-35	5·6	1·5
1935-36	5·7	1·7
1936-37	6·4	1·9
1937-38	5·8	1·6
1938-39	5·5	1·5
1939-40	5·4	1·7
1940-41	5·1	1·6
1941-42	5·3	1·4
1942-43	5·0	1·9

Statement 66

Acreage and Production of LINSEED in Bihar and Orissa

	(Thousand acres)	(Thousand tons)
1911-12	568	125
1912-13	677	135
1913-14	653	150
1914-15	661	108
1915-16	703	144
1916-17	678	140
1917-18	745	172
1918-19	595	98
1919-20	727	160
1920-21	648	121
1921-22	701	165
1922-23	746	156
1923-24	724	142
1924-25	731	123
1925-26	687	103
1926-27	644	98
1927-28	601	84
1928-29	658	108
1929-30	655	107
1930-31	654	94
1931-32	654	91
1932-33	641	97
1933-34	632	92
1934-35	599	93
1935-36	510	76
1936-37	559	85
1937-38	595	88
1938-39	584	80
1939-40	568	78
1940-41	543	72
1941-42	553	77
1942-43	573	83

Statement 67

Acreage and Production of LINSEED in the Central Provinces and Berar

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,859	130
1912-13	1,509	142
1913-14	952	71
1914-15	1,222	80
1915-16	1,018	83
1916-17	1,180	99
1917-18	1,257	93
1918-19	509	16
1919-20	978	68
1920-21	447	16
1921-22	767	65
1922-23	1,019	123
1923-24	1,300	77
1924-25	1,003	100
1925-26	1,148	72
1926-27	1,001	75
1927-28	917	72
1928-29	920	54
1929-30	754	65
1930-31	739	65
1931-32	937	87
1932-33	1,008	83
1933-34	933	80
1934-35	997	88
1935-36	1,131	80
1936-37	1,182	88
1937-38	1,287	106
1938-39	1,289	105
1939-40	1,203	100
1940-41	1,218	97
1941-42	986	54
1942-43	1,038	75

Statement 68

Acreage and Production of LINSEED in the United Provinces

1911-12	1,590	300
1912-13	1,161	224
1913-14	608	98
1914-15	886	158
1915-16	915	189
1916-17	1,005	205
1917-18	1,051	177
1918-19	390	72
1919-20	790	149
1920-21	597	105
1921-22	943	162
1922-23	1,019	198
1923-24	1,030	158
1924-25	1,105	205
1925-26	1,083	168
1926-27	1,061	181
1927-28	1,053	137
1928-29	760	105
1929-30	731	147
1930-31	954	154
1931-32	910	158
1932-33	852	147
1933-34	806	116
1934-35	862	139
1935-36	845	147
1936-37	908	148
1937-38	950	157
1938-39	927	118
1939-40	912	171
1940-41	841	161
1941-42	825	137
1942-43	858	152

Statement 69

Acreage and Production of SESAMUM in the Central Provinces and Berar

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	886	72
1912-13	778	61
1913-14	866	69
1914-15	926	86
1915-16	908	91
1916-17	682	50
1917-18	408	24
1918-19	498	34
1919-20	489	48
1920-21	698	52
1921-22	777	78
1922-23	577	46
1923-24	562	46
1924-25	644	62
1925-26	433	27
1926-27	458	38
1927-28	553	52
1928-29	637	58
1929-30	496	37
1930-31	577	49
1931-32	505	38
1932-33	604	47
1933-34	570	43
1934-35	338	20
1935-36	413	33
1936-37	466	38
1937-38	483	39
1938-39	438	34
1939-40	472	35
1940-41	477	39
1941-42	501	40
1942-43	469	36

Statement 70

Acreage and Production of SESAMUM in Madras

1911-12	887	73
1912-13	813	65
1913-14	809	72
1914-15	861	77
1915-16	823	70
1916-17	770	105
1917-18	832	114
1918-19	681	87
1919-20	881	117
1920-21	753	91
1921-22	778	92
1922-23	733	96
1923-24	696	86
1924-25	780	105
1925-26	701	106
1926-27	682	85
1927-28	837	107
1928-29	760	99
1929-30	773	101
1930-31	746	98
1931-32	747	97
1932-33	836	112
1933-34	936	106
1934-35	653	79
1935-36	727	84
1936-37	802	100
1937-38	795	96
1938-39	876	91
1939-40	734	90
1940-41	786	101
1941-42	693	84
1942-43	793	81

Statement 71

Acreage and Production of SESAMUM in the United Provinces

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,175	99
1912-13	1,217	134
1913-14	1,228	60
1914-15	1,372	116
1915-16	1,390	126
1916-17	1,278	108
1917-18	1,038	82
1918-19	1,132	46
1919-20	1,143	115
1920-21	1,151	103
1921-22	1,225	128
1922-23	1,073	98
1923-24	1,122	112
1924-25	1,095	103
1925 26	921	91
1926-27	936	100
1927 28	1,043	105
1928-29	1,102	93
1929 30	1,182	101
1930 31	1,104	112
1931-32	1,212	123
1932 33	1,227	123
1933-34	1,340	128
1934-35	1,057	93
1935 36	1,179	103
1936-37	1,065	104
1937-38	1,323	115
1938-39	1,301	101
1939 40	1,285	126
1940 41	1,280	122
1941-42	1,362	113
1942-43	1,440	156

Statement 72

Acreage and Production of RAPE and MUSTARD in Assam

1911-12	282	52
1912-13	298	58
1913-14	311	61
1914-15	310	58
1915-16	326	50
1916-17	278	50
1917-18	264	47
1918-19	286	51
1919 20	315	62
1920-21	311	56
1921-22	308	57
1922-23	315	56
1923-24	349	66
1924-25	354	64
1925 26	358	74
1926-27	365	72
1927-28	353	69
1928-29	360	64
1929 30	332	61
1930-31	359	63
1931-32	302	46
1932-33	271	43
1933 34	330	57
1934-35	345	54
1935-36	363	45
1936-37	401	55
1937-38	397	59
1938-39	406	65
1939-40	406	65
1940 41	387	59
1941-42	376	57
1942 43	384	48

Statement 73

Acreage and Production of RAPE and MUSTARD in Bengal

Year	Area (Thousand acres)	Production (Thousand tons)
1911-12	1,316	244
1912-13	1,325	266
1913-14	1,322	264
1914-15	1,316	232
1915-16	1,322	273
1916-17	1,225	238
1917-18	1,164	211
1918-19	1,125	169
1919-20	1,100	187
1920-21	882	163
1921-22	895	145
1922-23	753	128
1923-24	733	118
1924-25	737	122
1925-26	731	84
1926-27	757	132
1927-28	741	116
1928-29	700	123
1929-30	705	134
1930-31	709	130
1931-32	770	139
1932-33	716	161
1933-34	693	161
1934-35	724	180
1935-36	711	167
1936-37	710	166
1937-38	771	157
1938-39	777	152
1939-40	704	112
1940-41	763	130
1941-42	741	137
1942-43	885	163

Statement 74

Acreage and Production of RAPE and MUSTARD in Bihar and Orissa

1911-12	780	172
1912-13	725	144
1913-14	762	166
1914-15	602	99
1915-16	725	137
1916-17	758	168
1917-18	825	191
1918-19	693	113
1919-20	827	182
1920-21	774	145
1921-22	767	175
1922-23	818	182
1923-24	805	156
1924-25	821	213
1925-26	753	103
1926-27	736	161
1927-28	700	153
1928-29	720	162
1929-30	665	162
1930-31	657	147
1931-32	630	135
1932-33	627	140
1933-34	598	135
1934-35	600	137
1935-36	571	112
1936-37	560	128
1937-38	543	122
1938-39	525	113
1939-40	534	114
1940-41	515	103
1941-42	515	110
1942-43	500	106

Statement 75

Acreage and Production of RAPE and MUSTARD in the Punjab

Year	Area	Production
	(Thousand acres)	(Thousand tons)
1911-12	1,456	200
1912-13	888	160
1913-14	1,003	167
1914-15	1,047	188
1915-16	1,129	146
1916-17	1,016	164
1917-18	1,259	196
1918-19	660	116
1919-20	891	178
1920-21	583	94
1921-22	1,464	234
1922-23	1,286	241
1923-24	1,141	196
1924-25	1,269	209
1925-26	752	125
1926-27	913	147
1927-28	951	150
1928-29	1,722	162
1929-30	1,071	151
1930-31	888	141
1931-32	1,150	184
1932-33	1,158	151
1933-34	1,099	131
1934-35	673	101
1935-36	705	113
1936-37	982	154
1937-38	740	105
1938-39	650	110
1939-40	1,107	148
1940-41	1,335	177
1941-42	1,023	157
1942-43	892	146

Statement 76

Acreage and Production of RAPE and MUSTARD in the United Provinces.

1911-12	3,053	647
1912-13	2,523	586
1913-14	2,309	351
1914-15	2,645	574
1915-16	2,586	485
1916-17	2,658	497
1917-18	2,969	427
1918-19	1,944	298
1919-20	2,588	536
1920-21	2,225	387
1921-22	2,292	477
1922-23	2,591	549
1923-24	2,720	559
1924-25	2,605	535
1925-26	2,598	429
1926-27	2,395	450
1927-28	2,756	297
1928-29	3,014	351
1929-30	2,661	524
1930-31	3,475	456
1931-32	2,037	468
1932-33	2,816	497
1933-34	2,818	404
1934-35	2,655	388
1935-36	2,583	480
1936-37	2,784	400
1937-38	2,589	517
1938-39	2,749	434
1939-40	2,808	589
1940-41	2,735	571
1941-42	3,097	586
1942-43	2,630	518

Statement 77

Acreage and Production of GROUNDNUT in Bombay and Sind

Year	Acreage	Production
	(Thousand acres)	(Thousand tons)
1912-13	190	188
1913-14	202	200
1914-15	222	222
1915-16	213	247
1916-17	220	207
1917-18	215	215
1918-19	136	74
1919-20	136	127
1920-21	205	153
1921-22	273	217
1922-23	330	207
1923-24	359	189
1924-25	344	201
1925-26	596	276
1926-27	602	313
1927-28	740	398
1928-29	1,000	526
1929-30	1,068	426
1930-31	999	487
1931-32	989	495
1932-33	1,195	579
1933-34	1,292	613
1934-35	862	375
1935-36	802	418
1936-37	987	407
1937-38	1,344	523
1938-39	1,436	582
1939-40	1,616	553
1940-41	1,680	663
1941-42	1,309	500
1942-43	1,124	418

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Acreage and Production of GROUNDNUT in Madras

1912-13	924	341
1913-14	1,605	411
1914-15	1,806	580
1915-16	1,136	633
1916-17	1,796	825
1917-18	1,415	680
1918-19	1,001	442
1919-20	1,144	569
1920-21	1,600	740
1921-22	1,459	678
1922-23	1,764	823
1923-24	1,807	744
1924-25	1,904	948
1925-26	2,598	1,264
1926-27	2,680	1,207
1927-28	3,337	1,071
1928-29	3,680	1,830
1929-30	3,209	1,522
1930-31	3,575	1,765
1931-32	2,035	1,234
1932-33	3,617	1,720
1933-34	3,779	1,777
1934-35	2,351	920
1935-36	2,620	1,202
1936-37	3,495	1,057
1937-38	4,658	2,059
1938-39	3,771	1,613
1939-40	3,618	1,703
1940-41	3,922	1,924
1941-42	2,781	1,185
1942-43	3,261	1,208

Statement

Acreage and Production of COTTON in Bombay including Sind

Year	Acreage	Production
	(Million acres)	(Thousand tons)
1911-12	4·4	107
1912-13	1·2	174
1913-14	1·5	185
1914-15	4·7	192
1915-16	3·4	128
1916-17	4·6	191
1917-18	4·7	155
1918-19	4·3	102
1919-20	4·3	200
1920 21	3·8	111
1921-22	3·0	130
1922-23	4·0	155
1923-24	4·9	164
1924 25	5·3	184
1925-26	5·5	187
1926-27	4·6	134
1927-28	4·9	175
1928-29	5·2	187
1929-30	4·8	111
1930-31	3·8	127
1931-32	4·3	155
1932 33	4·2	160
1933-34	4·2	154
1934-35	4·3	147
1935-36	4·9	200
1936-37	4·6	203
1937-38	4·8	194
1938-39	4·6	182
1939-40	4·6	176
1940-41	1·8	109
1941-42	5·0	221
1942-43	3·1	158

Statement 80

Acreage and Production of COTTON in the Central Provinces and Berar

1911-12	4·6	163
1912-13	4·5	163
1913-14	4·8	172
1914-15	4·7	194
1915-16	4·0	193
1916-17	4·5	126
1917-18	4·5	104
1918-19	4·1	144
1919-20	4·6	230
1920-21	4·5	92
1921-22	4·4	201
1922-23	4·9	186
1923-24	4·9	182
1924-25	5·2	179
1925-26	5·4	175
1926-27	4·9	174
1927-28	4·8	221
1928-29	5·1	238
1929-30	5·2	224
1930-31	4·8	203
1931-32	4·6	89
1932-33	4·0	126
1933-34	4·3	128
1934-35	4·2	106
1935-36	4·1	114
1936-37	4·0	141
1937-38	4·0	127
1938-39	3·7	96
1939-40	3·3	129
1940-41	3·6	161
1941-42	3·8	176
1942-43	3·2	91

Statement 81

Acreage and Production of COTTON in Madras

Year	Acreage	Production
	(Thousand acres)	(Thousand tons)
1911-12	2,676	55
1912-13	2,389	50
1913-14	2,097	51
1914-15	1,087	13
1915-16	2,060	43
1916-17	2,168	62
1917-18	2,700	90
1918-19	3,133	104
1919-20	2,339	73
1920-21	2,122	63
1921-22	1,783	60
1922-23	2,323	77
1923-24	2,628	86
1924-25	2,860	101
1925-26	2,897	101
1926-27	2,201	69
1927-28	2,100	79
1928-29	2,465	94
1929-30	2,477	91
1930-31	2,041	68
1931-32	2,205	75
1932-33	1,950	73
1933-34	2,156	80
1934-35	2,308	85
1935-36	2,664	97
1936-37	2,487	88
1937-38	2,546	90
1938-39	1,920	76
1939-40	2,196	81
1940-41	2,413	95
1941-42	2,541	100
1942-43	2,172	73

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Acreage and Production of COTTON in the Punjab

1911-12	1,403	37
1912-13	1,143	53
1913-14	1,826	93
1914-15	1,658	74
1915-16	827	30
1916-17	1,065	51
1917-18	1,013	48
1918-19	1,118	73
1919-20	2,071	111
1920-21	1,957	93
1921-22	1,140	49
1922-23	1,273	61
1923-24	1,749	102
1924-25	2,326	142
1925-26	2,702	141
1926-27	2,524	93
1927-28	1,841	92
1928-29	2,509	91
1929-30	2,200	125
1930-31	2,164	119
1931-32	2,160	98
1932-33	1,800	99
1933-34	2,449	166
1934-35	2,317	169
1935-36	2,803	220
1936-37	3,000	260
1937-38	3,136	204
1938-39	2,902	197
1939-40	2,641	182
1940-41	2,669	217
1941-42	2,801	219
1942-43	2,332	192

Statement 83

Acreage and Production of SUGARCANE in Bengal

Year	Acreage	Production
	(Thousand acres)	(Thousand tons)
1911-12	223	256
1912-13	222	263
1913-14	217	245
1914-15	233	260
1915-16	234	259
1916-17	220	228
1917-18	207	241
1918-19	219	223
1919-20	218	256
1920-21	219	255
1921-22	221	239
1922-23	201	212
1923-24	208	223
1924-25	206	210
1925-26	215	245
1926-27	201	215
1927-28	209	236
1928-29	196	216
1929-30	198	220
1930-31	199	248
1931-32	233	273
1932-33	233	454
1933-34	257	457
1934 35	276	492
1935-36	325	560
1936-37	355	626
1937-38	290	483
1938-39	299	439
1939-40	316	526
1940-41	331	532
1941-42	314	457
1942-43	303	412

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Acreage and Production of SUGARCANE in Bihar and Orissa

1911-12	263	304
1912-13	271	298
1913-14	263	289
1914-15	260	277
1915-16	262	260
1916-17	279	305
1917-18	265	291
1918-19	275	273
1919-20	275	318
1920-21	287	300
1921-22	306	337
1922-23	306	290
1923-24	307	319
1924-25	287	250
1925-26	290	314
1926-27	289	303
1927-28	290	310
1928-29	287	313
1929-30	279	301
1930-31	284	307
1931-32	282	307
1932-33	302	313
1933-34	418	623
1934-35	445	673
1935-36	480	687
1936-37	492	545
1937-38	396	456
1938-39	407	431
1939 10	474	525
1940-41	543	585
1941-42	416	451
1942-43	436	477

Statement 85

Acreage and Production of SUGARCANE in the Punjab

Years	Acreage	Production
	(Thousand acres)	(Thousand tons)
1911-12	298	180
1912-13	367	272
1913-14	411	326
1914-15	366	268
1915-16	347	276
1916-17	414	352
1917-18	503	437
1918-19	474	293
1919-20	482	428
1920-21	457	316
1921-22	373	276
1922-23	497	411
1923-24	483	418
1924-25	396	330
1925-26	390	303
1926-27	443	349
1927-28	499	381
1928-29	401	289
1929-30	307	201
1930-31	426	302
1931-32	475	368
1932-33	556	444
1933-34	466	364
1934-35	462	326
1935-36	474	360
1936-37	554	466
1937-38	510	389
1938-39	354	220
1939-40	417	318
1940-41	519	470
1941-42	458	412
1942-43	440	431

Statement 86

Acreage and Production of SUGARCANE in the United Provinces

	(Thousand acres)	(Million tons)
1911-12	1,311	1·3
1912-13	1,424	1·3
1913-14	1,380	1·0
1914-15	1,191	1·2
1915-16	1,261	1·3
1916-17	1,201	1·2
1917-18	1,484	1·6
1918-19	1,544	1·0
1919-20	1,414	1·5
1920-21	1,286	1·0
1921-22	1,152	1·1
1922-23	1,349	1·3
1923-24	1,544	1·6
1924-25	1,201	1·1
1925-26	1,410	1·4
1926-27	1,613	1·7
1927-28	1,585	1·5
1928-29	1,315	1·2
1929-30	1,349	1·3
1930-31	1,488	1·0
1931-32	1,570	2·2
1932-33	1,773	2·6
1933-34	1,713	2·5
1934-35	1,813	2·7
1935-36	2,212	3·3
1936-37	2,465	3·8
1937-38	2,181	3·1
1938-39	1,628	1·4
1939-40	1,870	2·1
1940-41	2,518	2·8
1941-42	1,755	1·8
1942-43	1,847	3·2

Statement 87

Population and Acreage of MAJOR FOOD GRAINS in Assam

Year	Population	Area
	(Million persons)	(Million acres)
1911-12	6·6	4·5
1912-13	..	4·5
1913-14	..	4·5
1914-15	..	4·5
1915-16	..	4·4
1916-17	..	4·5
1917-18	..	4·6
1918-19	..	4·4
1919-20	..	4·3
1920-21	..	4·4
1921-22	7·5	4·3
1922-23	..	4 4
1923-24	..	4·6
1924-25	..	4·5
1925-26	..	4·4
1926-27	..	4·5
1927-28	..	4·2
1928-29	..	4·7
1929-30	..	1·1
1930-31	..	4·5
1931-32	8·6	4·6
1932-33	..	4·7
1933-34	..	4·7
1934-35	..	4·8
1935-36	..	5·3
1936-37	..	5·4
1937-38	..	5·1
1938-39	..	5 4
1939-40	..	5·4
1940-41	..	5·4
1941-42	10·2	5·0
1942-43	..	5·1

Statement 88

Population and Acreage of MAJOR FOOD GRAINS in Bengal

1911-12	45·5	21·5
1912-13	..	21·7
1913-14	..	20·3
1914-15	..	21·6
1915-16	..	21·5
1916-17	..	21·6
1917-18	..	21·5
1918-19	..	21·8
1919-20	..	21·4
1920-21	..	21·4
1921-22	46·7	22·3
1922-23	..	22·2
1923-24	..	20·8
1924-25	..	21·3
1925-26	..	21·6
1926-27	..	20·1
1927-28	..	19·0
1928-29	..	21·9
1929-30	..	20·7
1930-31	..	21·1
1931-32	50·1	22·6
1932-33	..	23·3
1933-34	..	22·2
1934-35	..	21·3
1935-36	..	21·6
1936-37	..	22·6
1937-38	..	22·8
1938-39	..	22·7
1939-40	..	22·9
1940-41	..	21·5
1941-42	60·3	24·5

Statement 89

Population and Acreage of MAJOR FOOD GRAINS in Bihar and Orissa

Year	Population	Area
	(Million persons)	(Million acres)
1911-12	36·9	22·8
1912-13	..	21·9
1913-14	..	21·9
1914-15	..	21·6
1915-16	..	22·0
1916-17	..	22·1
1917-18	..	21·6
1918-19	..	20·2
1919-20	..	21·2
1920 21	..	20·7
1921-22	36·4	21·2
1922-23	..	21·3
1923-24	..	19·8
1924-25	..	20·2
1925-26	..	19·9
1926-27	..	19·7
1927-28	..	19·1
1928-29	..	19·9
1929-30	..	20·1
1930-31	..	19·8
1931-32	40·4	20·0
1932-33	..	19·3
1933-34	..	19·1
1934-35	..	19·7
1935-36	..	20·4
1936-37	..	20·8
1937-38	..	20·2
1938-39	..	20·2
1939-40	..	20·2
1940-41	..	19·8
1941 42	45·1	19·6

Statement 90

Population and Acreage of MAJOR FOOD GRAINS in Bombay (including Sind)

1911-12	19·7	16·4
1912-13	..	19·8
1913-14	..	19·6
1914-15	..	19·7
1915-16	..	19·8
1916-17	..	20·1
1917-18	..	19·8
1918-19	..	15·4
1919-20	..	19·8
1920-21	..	17·9
1921-22	19·3	20·6
1922-23	..	19·8
1923-24	..	18·7
1924-25	..	19·3
1925-26	..	18·4
1926-27	..	19·5
1927-28	..	19·5
1928-29	..	19·0
1929-30	..	20·0
1930-31	..	20·9
1931-32	21·9	19·8
1932-33	..	20·3
1933-34	..	20·6
1934-35	..	20·4
1935-36	..	20·1
1936-37	..	20·5
1937-38	..	20·9
1938-39	..	20·6
1939-40	..	20·5
1940-41	..	21·0
1941-42	25·4	20·7

Statement 91

Population and Acreage of MAJOR FOOD GRAINS in the Central Provinces and Berar

Year	Population	Area
	(Million persons)	(Million acres)
1911-12	13·8	13·9
1912-13	..	14·0
1913-14	..	13·6
1914-15	..	14·0
1915-16	..	14·9
1916-17	..	14·6
1917-18	..	14·7
1918-19	..	14·0
1919-20	..	14·0
1920-21	..	13·4
1921-22	13·7	13·7
1922-23	..	14·1
1923 24	..	14·0
1924 25	..	14·1
1925-26	..	14·1
1926 27	..	14·6
1927-28	..	14·7
1928 29	..	14·4
1929-30	..	14·2
1930-31	..	15·0
1931-32	15·3	14·9
1932-33	..	14·9
1933-34	..	14·9
1934-35	..	15·1
1935-36	..	14·7
1936-37	..	14·9
1937-38	..	14·8
1938-39	..	14·9
1939-40	..	15·2
1940-41	..	15·1
1941-42	16·8	14·8

Statement 92

Population and Acreage of MAJOR FOOD GRAINS in Madras

1911-12	39·1	19·1
1912-13	..	20·0
1913-14	..	20·9
1914-15	..	19·7
1915-16	..	20·7
1916-17	..	20·0
1917-18	..	20·1
1918-19	..	18·8
1919-20	..	20·6
1920-21	..	19·6
1921-22	40·1	20·3
1922-23	..	19·9
1923-24	..	18·1
1924-25	..	19·1
1925-26	..	19·2
1926-27	..	18·8
1927-28	..	19·3
1928-29	..	18·9
1929-30	..	19·5
1930-31	..	19·6
1931-32	44·2	19·5
1932-33	..	19·1
1933-34	..	18·9
1934-35	..	19·1
1935-36	..	17·7
1936-37	..	17·9
1937-38	..	17·4
1938-39	..	17·6
1939-40	..	17·9
1940-41	..	18·1
1941-42	49·3	17·7

Population and Area of MAJOR FOOD GRAINS in the North-West Frontier Province

Year	Population (Million persons)	Area (Million acres)
1911-12	2·3	
1912-13		
1913-14		
1914-15		
1915-16		
1916-17		
1917-18		
1918-19		
1919-20		
1920-21		
1921-22		
1922-23		
1923-24		
1924-25		
1925-26		
1926-27		
1927-28		
1928-29		
1929-30		
1930-31		
1931-32		
1932-33		
1933-34		
1934-35		
1935-36		
1936-37		
1937-38		
1938-39		
1939-40		
1940-41		
1941-42	2·6	

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Population and Acreage of MAJOR FOOD GRAINS in the Punjab

1911-12	19·6	
1912-13		
1913-14		
1914-15		
1915-16		
1916-17		
1917-18		
1918-19		
1919-20		
1920-21		
1921-22	20·7	
1922-23		
1923-24		
1924-25		
1925-26		
1926-27		
1927-28		
1928-29		
1929-30		
1930-31		
1931-32	21·6	
1932-33		
1933-34		
1934-35		
1935-36		
1936-37		
1937-38		
1938-39		
1939-40		
1940-41		
1941-42	23·4	
1942-43		

Statement 95

Population and Acreage of MAJOR FOOD GRAINS in the United Provinces

Year	Population	Area
	(Million persons)	(Million acres)
1911-12	46 8	31·5
1912-13	..	31·6
1913-14	..	26·7
1914-15	.	31·3
1915-16	..	32·5
1916-17	..	33·1
1917-18	..	33·0
1918-19	.	25·8
1919-20	.	30·7
1920 21	.	28·3
1921-22	45·4	31·8
1922-23	..	32·2
1923-24	..	31·8
1924-25	.	31·3
1925-26	.	30·6
1926-27	..	30·4
1927-28	..	31·5
1928-29	..	30·6
1929-30	..	29·8
1930-31	..	30·9
1931-32	48·4	31·3
1932-33	..	30·1
1933-34	..	31·2
1934-35	..	30·5
1935-36	..	30·2
1936-37	.	31·1
1937-38	..	31·0
1938-39	..	32·2
1939-40	..	31·9
1940-41	..	31·0
1941-42	55·0	30 7

Statement 96

Acreage and Production of COTTON in India* 1911-12 to 1942-43

(Source : Area and Yield of Principal Crops in India and Cotton Forecasts)

Year	Area	Yield
	in million acres	in thousand tons (lint)
1911-12	21·4	587
1912-13	22·0	700
1913-14	25·0	905
1914-15	24·6	903
1915-16	17·7	668
1916-17	21·7	802
1917-18	25·3	724
1918-19	21·0	710
1919-20	23·4	1,036
1920-21	21·3	643
1921-22	18·5	801
1922-23	21·8	906
1923-24	23·6	922
1924-25	26·8	1,037
1925 26	28 4	1,110
1926 27	24·8	897
1927-28	24·8	1,065
1928-29	27·1	1,033
1929 30	25·9	936
1930 31	23·8	933
1931-32	23·5	724
1932-33	22·2	805
1933-34	23·7	896
1934-35	23·5	853
1935-36	25·4	1,052
1936-37	21·8	1,102
1937-38	25·7	1,021
1938 39	23·5	902
1939-40	21·6	877
1940-41	23·3	1,086
1941-42	21·2	1,094
1942-43	18·8	813

*Excludes Burma from 1931-32

Statement 97

Acreage and Production of RICE, WHEAT and COTTON in Sind

Year	Rice		Wheat		Cotton	
	Acreage (000)	Production (000 tons)	Acreage (000)	Production (000 tons)	Acreage (000)	Production (000 bales)
1928-29	1,178	320	409	82	390	Not available
1929-30	1,243	170	677	199	320	Do.
1930-31	1,269	340	391	169	280	Do.
1931-32	1,183	525	469	118	256	Do.
1932-33	1,103	448	969	270	343	Do.
1933-34	1,118	461	1,300	303	521	186
1934-35	1,129	378	1,075	251	623	270
1935-36	1,125	385	1,119	292	768	308
1936-37	1,182	155	931	311	894	473
1937-38	1,231	480	1,155	368	970	354
1938-39	1,256	197	1,178	365	856	364
1939-40	1,329	443	1,271	327	854	309
1940-41	1,420	427	1,203	331	931	336
1941-42	1,377	443	1,192	368	938	498
1942-43	1,316	322	1,356	429	725	394

Sources—
(1) *Agricultural Statistics of India*, (2) *Estimates of Area and Yield and* (3) *Season and Crop Reports, Bombay.*

Statement 98

Acreage and Production of RICE in India

Year	Acreage (000) acres)				Production (000 tons)			
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States	Other non-reporting tracts	Total
1911-12								
1912-13								
1913-14								
1914-15								
1915-16								
1916-17								
1917-18								
1918-19								
1919-20								
1920-21								
1921-22								
1922-23								
1923-24								
1924-25	69,329	2,968	2,535	74,832	26,005	1,077	975	28,057
1925-26	70,106	2,954	2,659	75,779	25,094	1,304	991	28,289
1926-27	67,248	3,079	2,655	72,982	24,568	1,392	989	26 949
1927-28	66,117	3,143	2,663	71,923	23,348	1,331	958	25,637
1928 29	70,312	3,520	2,702	76,534	27,256	1,797	1,042	30,095
1929-30	67,619	3,239	2,768	73,626	26,145	1,627	1,066	28,839
1930-31	69,603	3,280	2,706	75,588	27,035	1,526	1,043	29,624
1931-32	71,715	3,268	2,733	77,716	28,799	1,441	1,071	31,311
1932-33	69,960	3,295	2,814	76,069	26,201	1,392	1,057	28,650
1933-34	70,310	3,746	2,787	76,173	25,730	1,458	1,038	28,226
1934-35	69,731	3,341	2,769	75,841	25,710	1,417	1,010	28,155
1935-36	70,998	3,157	2,821	76,976	23,200	1,017	962	25,188
1936-37	72,295	3,091	2,848	78,234	27,824	1,389	1,120	30,333
1937-38	72,568	2,850	2,839	78,257	26,699	1,319	1,050	29,068
1938-39	73,398	2,057	2,878	79,233	23,062	944	910	25,846
1939-40	74,278	2,996	2,930	80,204	25,734	1,117	1,015	27,866
1940-41	73,063	2,454	1,917	77,434	22,191	791	582	23,564
1941-42								
1942 43								

Source :—*Estimates of Area and Yield.*

Statement 99

Acreage and Production of WHEAT in India

Year	Acreage (000 acres)				Production (000 tons)			
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total
1921-22	28,207	2	384	28,593	9,830	1	133	9,964
1922-23	30,852	3	394	31,249	9,974	1	127	10,102
1923-24	31,181	3	426	31,610	9,660	1	134	9,795
1924-25	31,778	3	441	32,222	8,866	1	120	8,987
1925-26	30,471	3	460	30,934	8,696	@	131	8,827
1926-27	31,303	2	456	31,761	8,973	@	130	9,103
1927-28	32,193	3	483	32,679	7,791	@	116	7,907
1928-29	31,973	2	510	32,485	8,592	@	135	8,727
1929-30	31,654	2	527	32,183	10,469	@	174	10,643
1930-31	32,189	3	508	32,700	9,306	@	147	9,453
1931-32	33,803	2	510	34,315	9,024	@	136	9,160
1932-33	32,976	2	510	33,488	9,455	@	145	9,600
1933-34	36,077	2	517	36,596	9,370	@	134	9,504
1934-35	34,490	2	498	34,990	9,729	@	140	9,869
1935-36	33,639	2	477	34,118	9,434	@	134	9,568
1936-37	33,215	2	497	33,714	9,752	@	147	9,899
1937-38	35,640	2	516	36,158	10,764	@	156	10,920
1938-39	35,141	2	639	36,082	9,963	@	180	10,143
1939-40	34,009	2	723	34,734	10,767	@	229	10,996
1940-41	34,662	1	739	35,602	10,005	@	212	10,217

Sources:—*Estimates of Area and Yield.* @Less than 500 tons.

Statement 100

Acreage and Production of LINSEED in India

Year	Acreage (000 acres)			Production (000 tons)		
	Main producing *areas*	Other non-reporting *tracts*	Total	Main producing *areas*	Other non-reporting *tracts*	Total
1924-25	3,695	..	..	501	28	529
1925-26	3,598	..	..	402	25	427
1926-27	3,331	..	..	406	30	436
1927-28	3,311	..	..	348	29	377
1928-29	3,109	..	..	322	30	352
1929-30	2,802	..	..	380	41	421
1930-31	3,009	..	..	377	39	416
1931-32	3,309	303	3,612	416	38	454
1932-33	3,299	276	3,575	406	34	440
1933-34	3,261	222	3,483	376	26	402
1934-35	3,410	225	3,635	420	28	448
1935-36	3,457	244	3,701	388	28	416
1936-37	3,677	210	3,896	420	25	445
1937-38	3,890	219	4,109	461	26	487
1938-39	3,869	214	4,083	442	24	466
1939-40	3,715	224	3,939	466	28	494
1940-41	3,606	230	3,845	432	29	461
1941-42						
1942-43						

Source : *Estimates of Area and Yield.*

Statement 101

Acreage and Production of SESAMUM in India

Year	Acreage (000 acres)				Production (000 tons)			
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total
1924-25	4,247	357	636	5,240	448	25	62	535
1925-26	3,891	232	636	4,759	376	9	54	439
1926-27	3,741	226	675	4,642	384	8	58	450
1927-28	4,453	232	675	5,360	498	15	67	580
1928-29	4,461	257	641	5,359	455	21	57	533
1929-30	4,121	250	621	4,992	405	17	54	476
1930-31	4,296	260	654	5,210	451	18	62	531
1931-32	4,331	237	680	5,248	446	17	58	521
1932-33	4,656	249	710	5,615	486	20	64	570
1933-34	4,608	233	674	5,605	474	16	58	548
1934-35	3,791	209	706	4,706	352	13	55	420
1935-36	4,135	187	730	5,052	413	10	60	483
1936-37	4,144	188	701	5,033	439	10	61	510
1937-38	4,450	203	687	5,340	465	12	69	546
1938-39	4,331	190	689	5,210	396	10	63	469
1939-40	4,031	137	682	4,850	415	17	70	502
1940-41	4,007	133	684	4,014	433	6	72	511
1941-42								
1942-43								

Source : *Estimates of Area and Yield.*

Statement 102

Acreage and Production of RAPE and MUSTARD in India

Year	Acreage ('000 acres)				Production ('000 tons)			
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total
1931-32	6,220	55	156	6,431	1,025	7	43	1,075
1932-33	6,094	45	270	6,419	1,012	7	17	1,036
1933-34	6,634	42	230	6,406	943	6	46	995
1934-35	5,338	41	200	5,579	909	6	49	935
1935-36	5,333	75	265	5,673	937	3	46	1,007
1936-37	5,899	76	203	6,178	964	5	44	1,013
1937-38	5,461	70	252	5,783	1,021	1	47	1,072
1938-39	5,536	70	257	5,862	923	5	43	971
1939-40	6,113	72	259	6,443	1,116	5	47	1,168
1940-41	6,159	69	251	6,310	1,094	3	45	1,142
1941-42								
1942-43								

Source : *Estimates of Area and Yield*

Statement 103

Acreage and Production of SUGARCANE in India

Years	Acreage (000 acres)				Production (000 tons)			
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other Non-reporting tracts	Total
1931-32	2,971	20	84	3 075	3,976	19	113	4,107
1932-33	3,317	22	83	3,422	4,676	20	117	4,813
1933-34	3,311	20	83	3,414	4,896	20	128	5 044
1934-35	3,481	22	84	3,587	5,140	22	124	5,286
1935-36	4,024	20	92	4,136	5,931	18	136	6,085
1936-37	4,440	18	81	4,539	6,176	19	123	6,318
1937-38	3,869	18	123	4,013	5,403	19	178	5,600
1938-39	3,130	17	140	3,287	3,397	17	185	3,599
1939-40	3,640	18	148	3,806	4,661	17	188	4,866
1940-41	4,593	13	151	4,762	5,807	14	191	6,012
1941-42								
1942-43								

Source : *Estimates of Area and yield.*

Statement 104

Acreage and Production of COTTON in India

Years	Acreage (000 acres)				Production				
	Main producing areas	Eastern Agency States (formerly Bihar and Orissa Feudatory States)	Other non-reporting tracts	Total	Main producing areas (000 bales)	Eastern Agency States (formerly Bihar and Orissa Feudatory States) (000 bales)	Other non reporting tracts	Total (000 bales)	Total (000 tons)
1921-22 ..	18,126	59	..	18,185	4,414	22	..	4,436	798
1922-23 ..	21,520	54	..	21,574	5,028	18	..	5,046	901
1923-24 ..	23,330	52	..	23,382	5,115	17	..	5,132	916
1924-25 ..	26,449	63	..	26,512	6,018	22	..	6,040	1,079
1925-26 ..	27,930	52	..	27,991	6,132	9	..	6,141	1,097
1926-27 ..	24,375	48	..	24,423	4,951	14	..	4,965	887
1927-28 ..	24,437	49	..	24,484	5,896	17	..	5,913	1,056
1928-29 ..	26,735	38	..	26,773	5,726	11	..	5,737	1,024
1929-30 ..	25,587	38	..	25,625	5,176	8	..	5,184	926
1930-31 ..	23,139	30	..	23,169	5,137	7	..	5,144	919
1931-32 ..	23,494	29	..	23,523	4,057	7	..	4,064	726
1932-33 ..	22,151	23	..	22,170	4,506	8	..	4,514	806
1933-34 ..	23,692	28	..	23,720	5,017	6	..	5,023	897
1934-35 ..	23,515	29	..	23,544	4,777	7	..	4,784	854
1935-36 ..	25,444	27	..	25,471	5,892	6	..	5,898	1,053
1936-37 ..	24,750	25	..	24,781	6,172	6	..	6,178	1,103
1937-38 ..	29,746	26	..	29,772	5,737	6	..	5,743	1,026
1938-39 ..	23,490	23	..	23,513	5,051	5	..	5,056	903
1939-40 ..	21,580	22	..	21,602	4 909	4	..	4,913	877
1940-41 ..	23,286	17	..	23,303	4,903	3	..	5,906	1,055

Source : *Estimates of Area and yield.*

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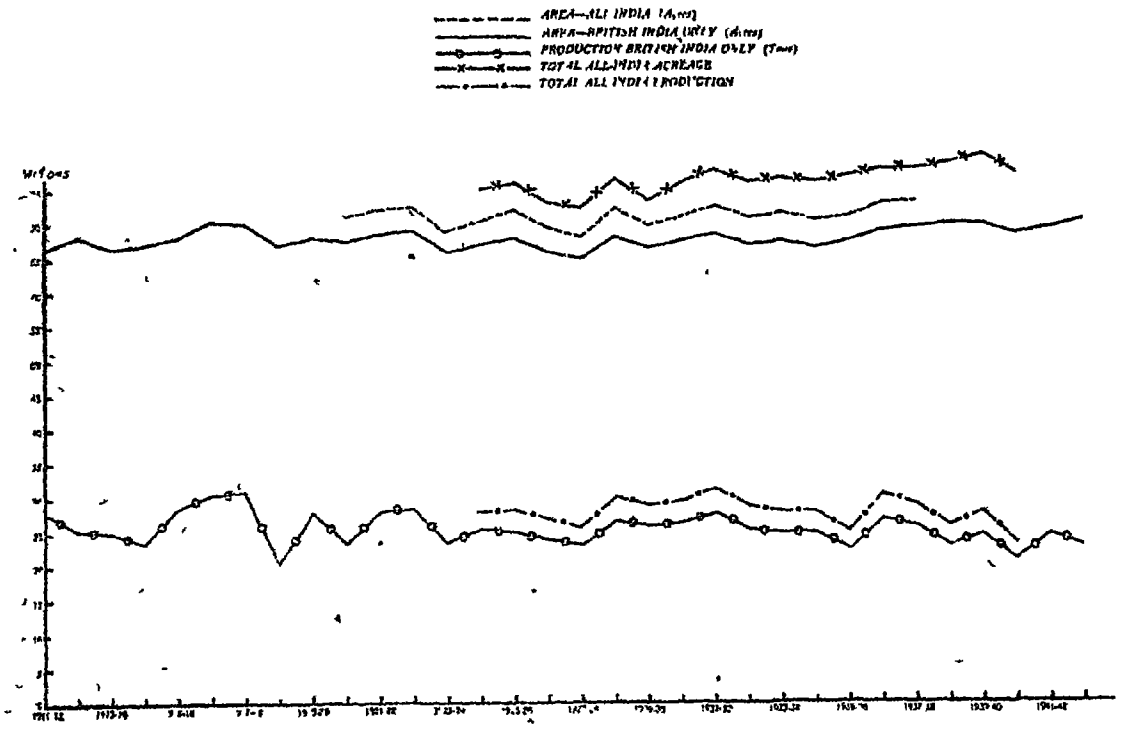
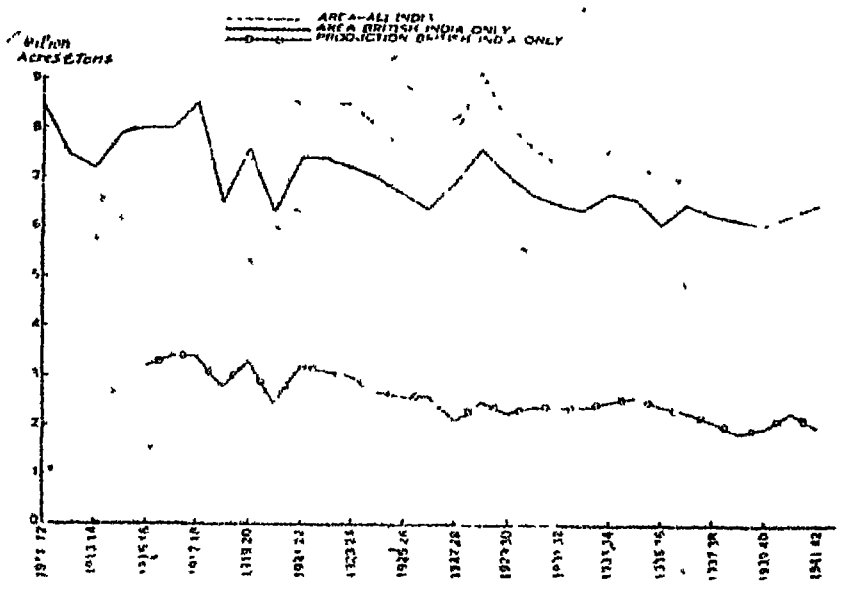
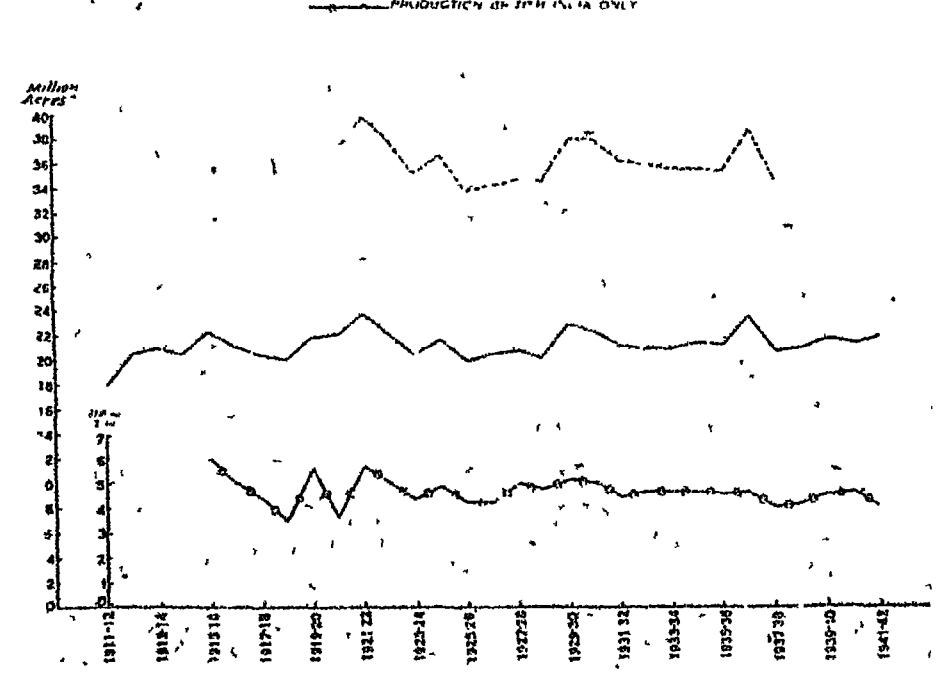
1. ACREAGE & PRODUCTION OF RICE IN INDIA



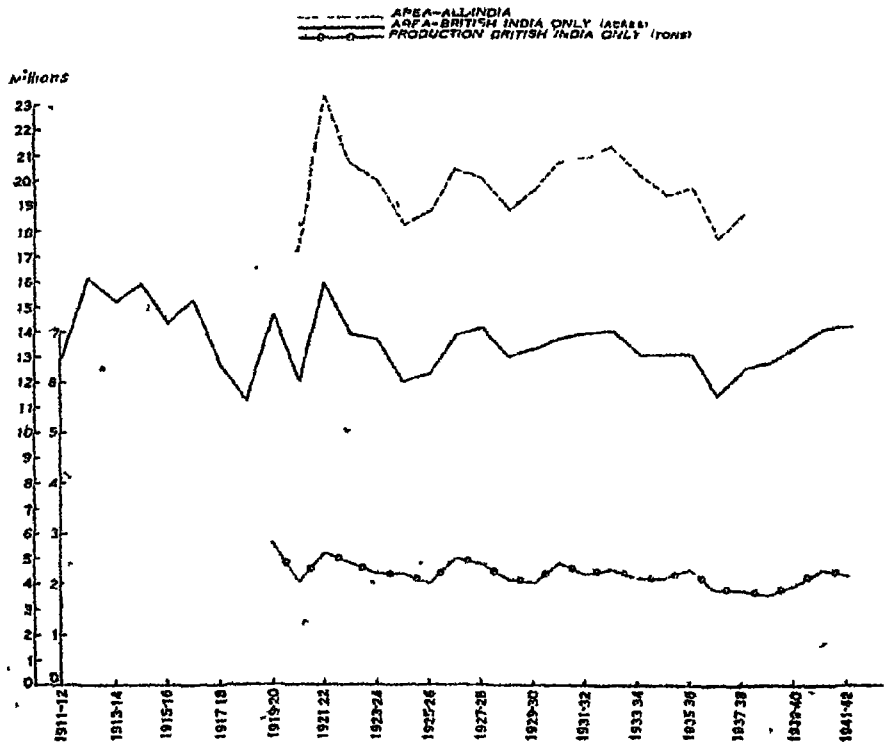
3 ACREAGE & PRODUCTION OF BARLEY IN INDIA



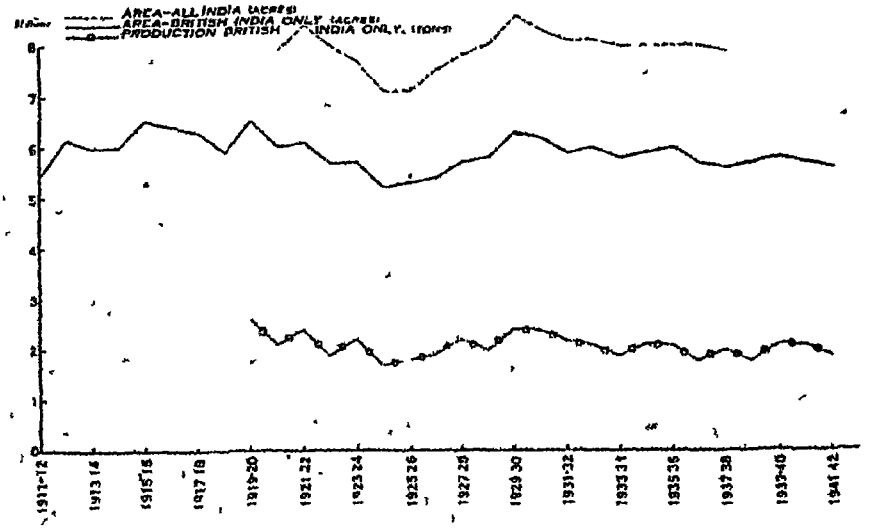
4 ACREAGE & PRODUCTION OF JUTE IN INDIA



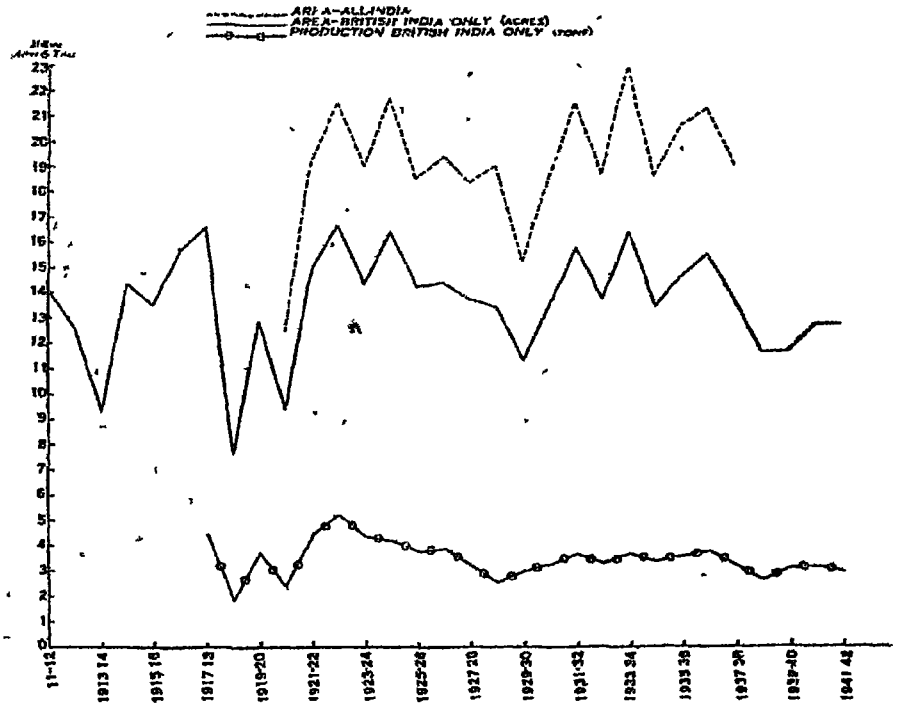
5. ACREAGE & PRODUCTION OF BAJRA IN INDIA



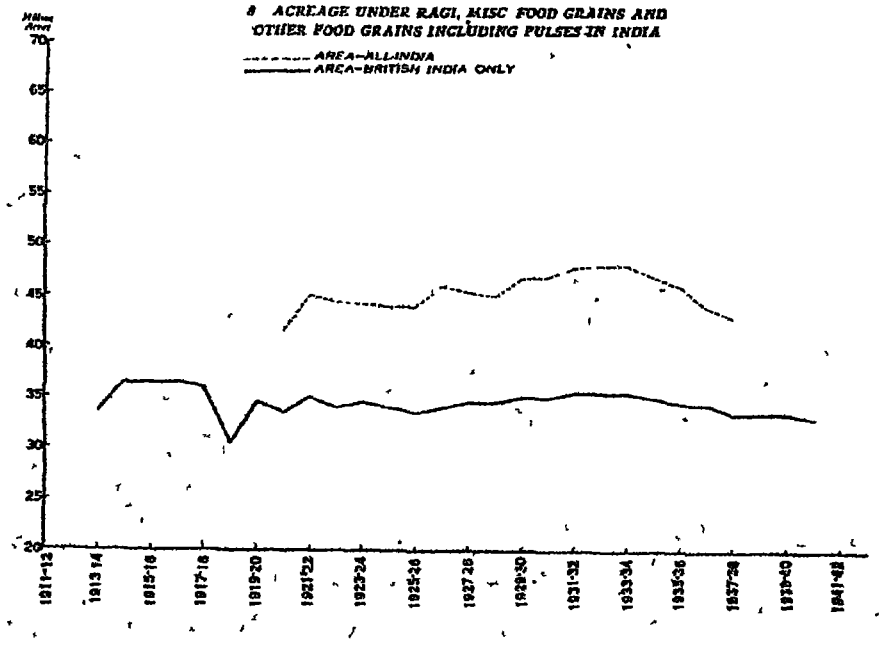
6. ACREAGE & PRODUCTION OF MAIZE IN INDIA



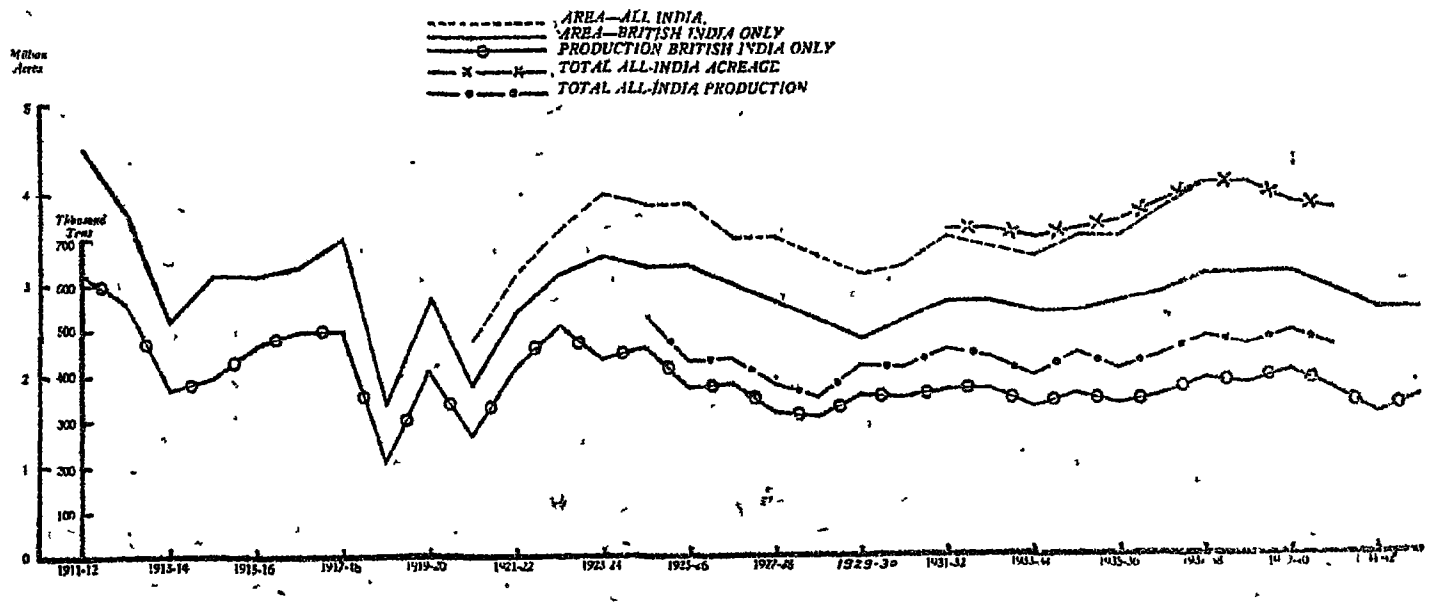
7. ACREAGE & PRODUCTION OF GRAM IN INDIA



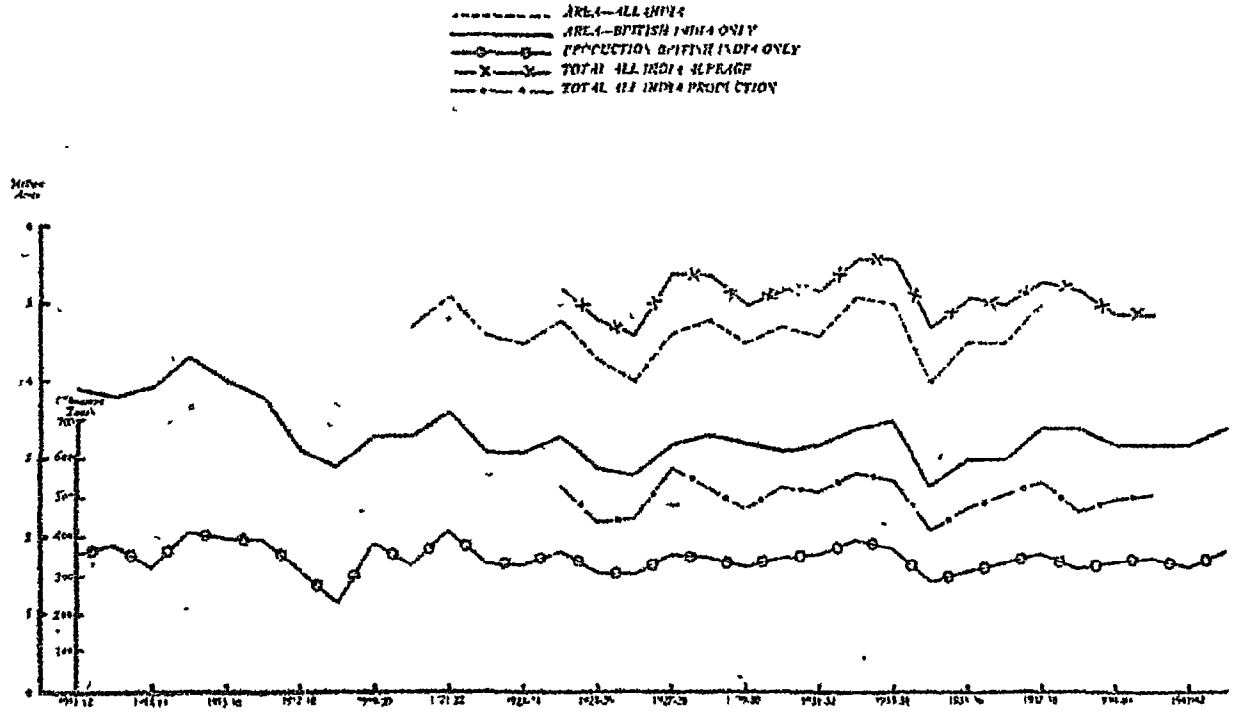
8 ACREAGE UNDER RAGI, MISC FOOD GRAINS AND OTHER FOOD GRAINS INCLUDING PULSES IN INDIA



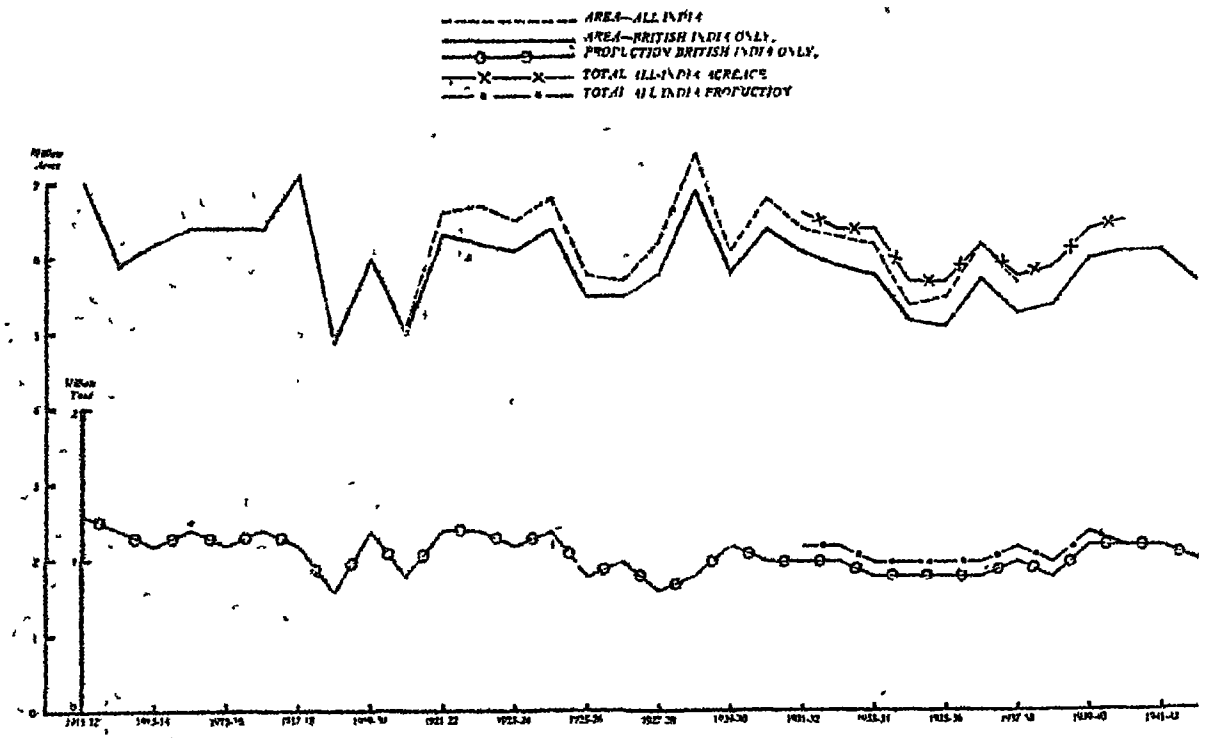
9. ACREAGE & PRODUCTION OF LINSEED IN INDIA



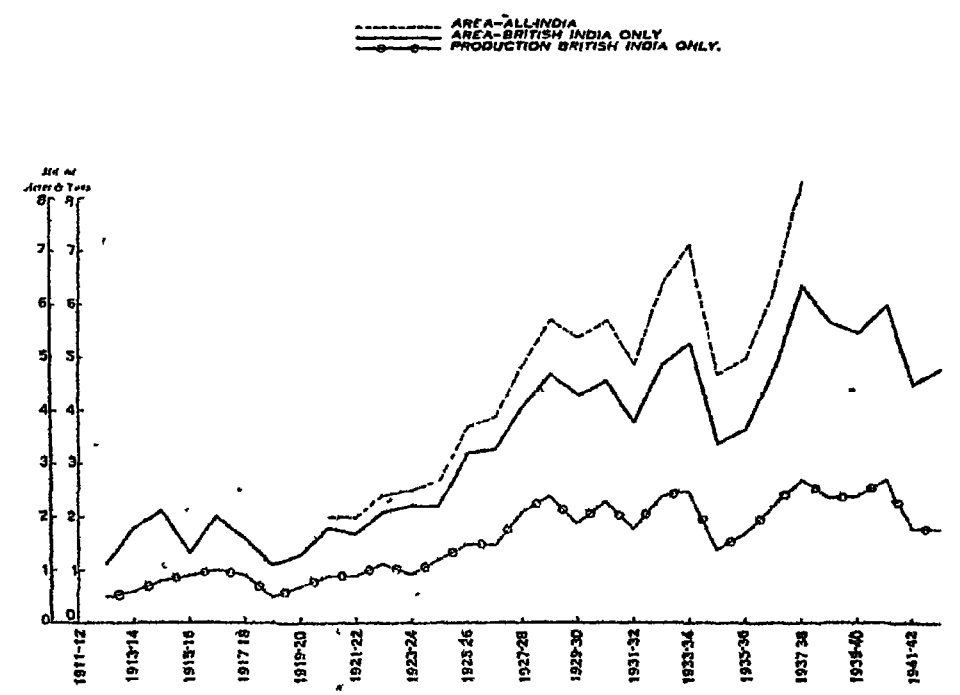
10. ACREAGE & PRODUCTION OF SESAMUM IN INDIA



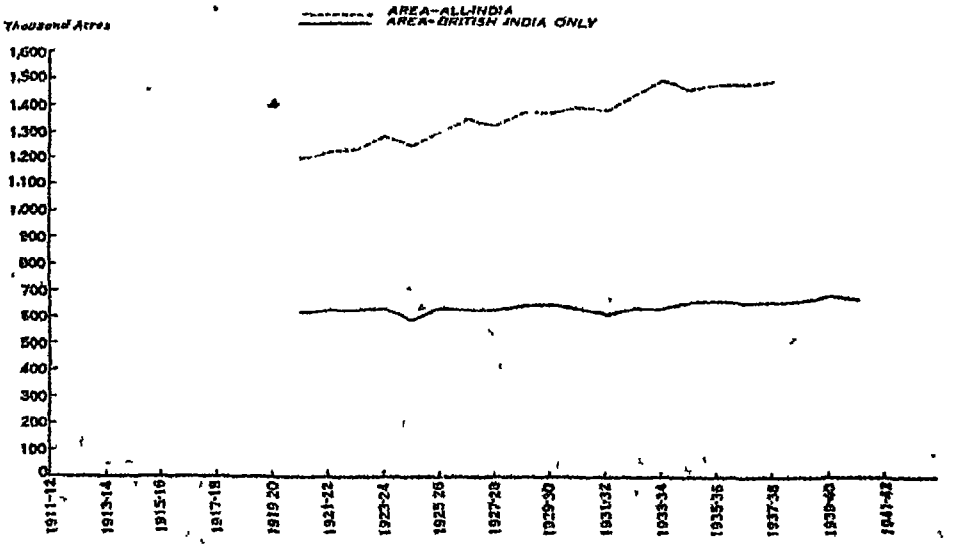
11. ACREAGE & PRODUCTION OF RAPESEED & MUSTARD IN INDIA



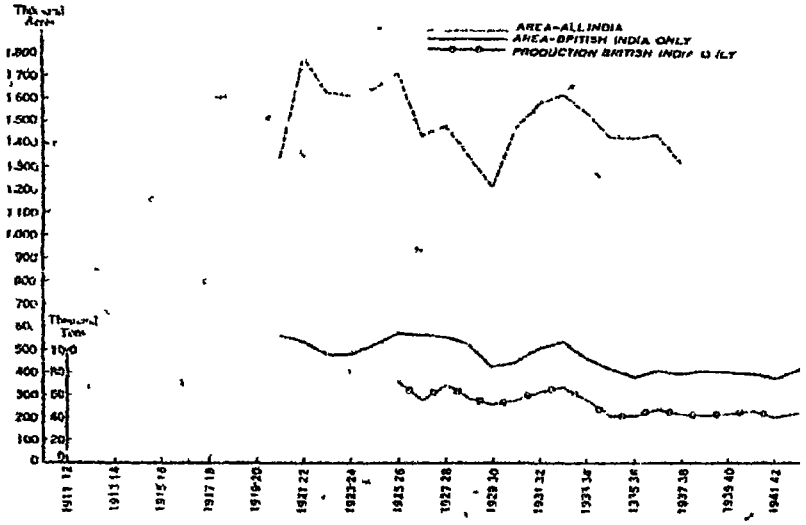
12. ACREAGE & PRODUCTION OF GROUNDNUT IN INDIA



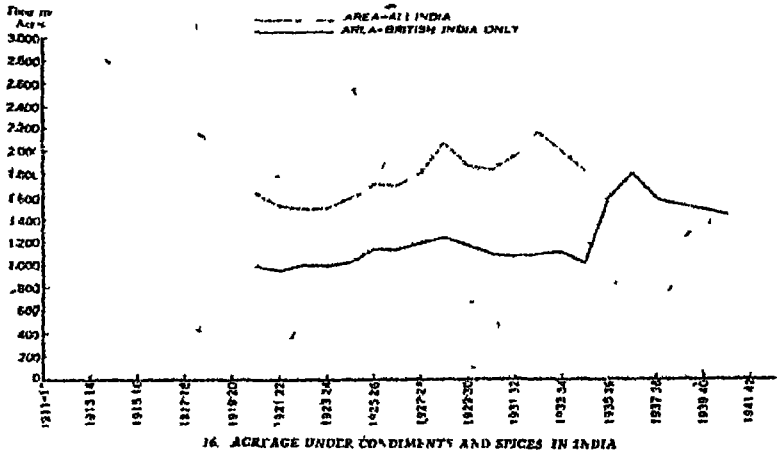
13 ACREAGE UNDER COCONUT IN INDIA



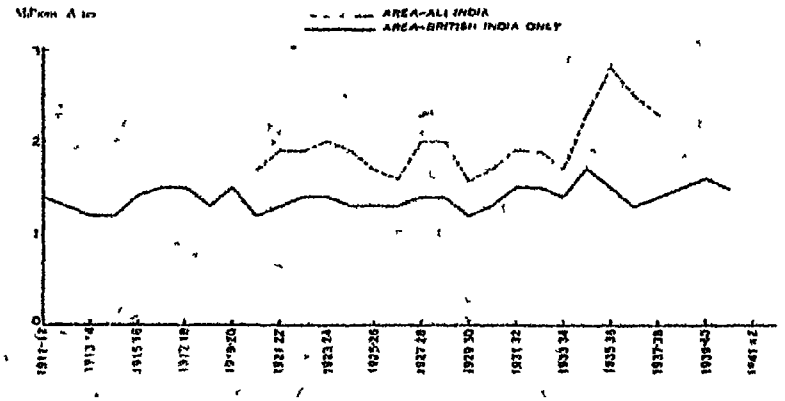
14 ACREAGE & PRODUCTION OF CASTOR SEED IN INDIA



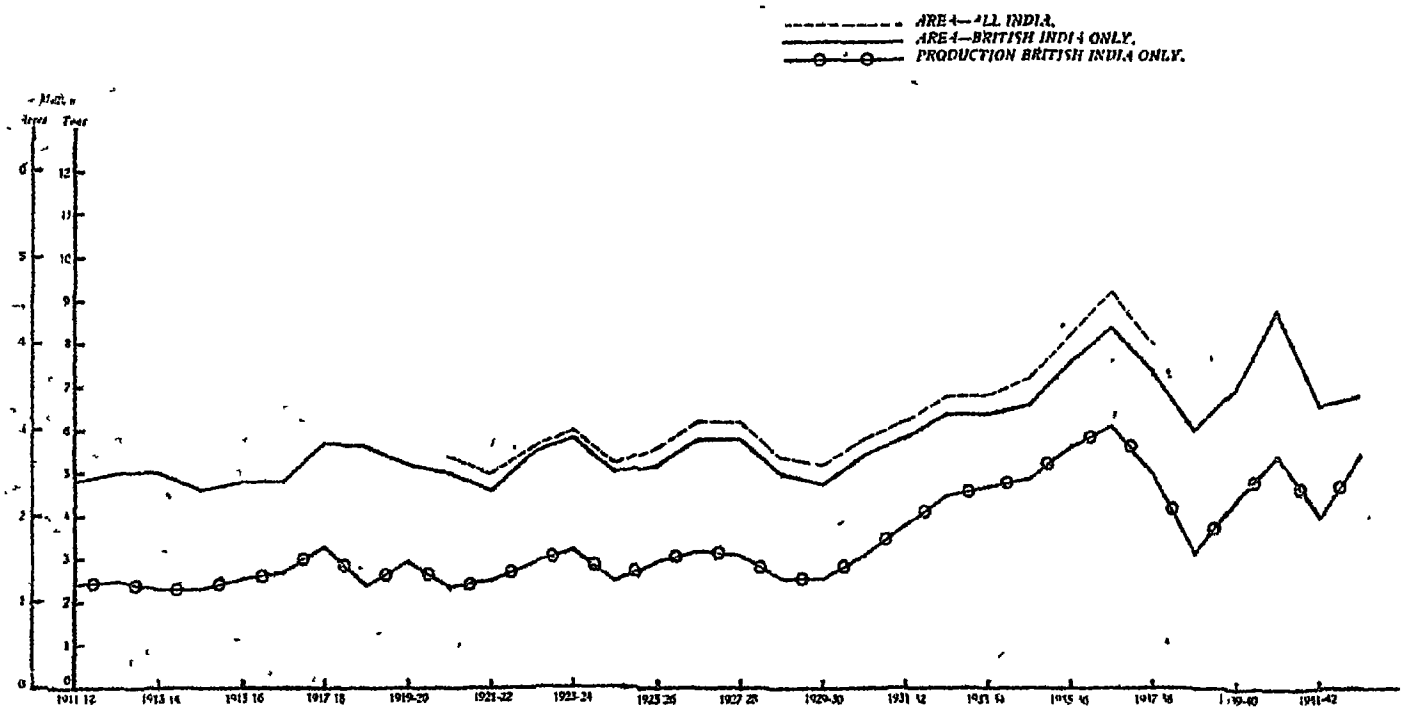
15 ACREAGE UNDER OTHER OILSEEDS IN INDIA



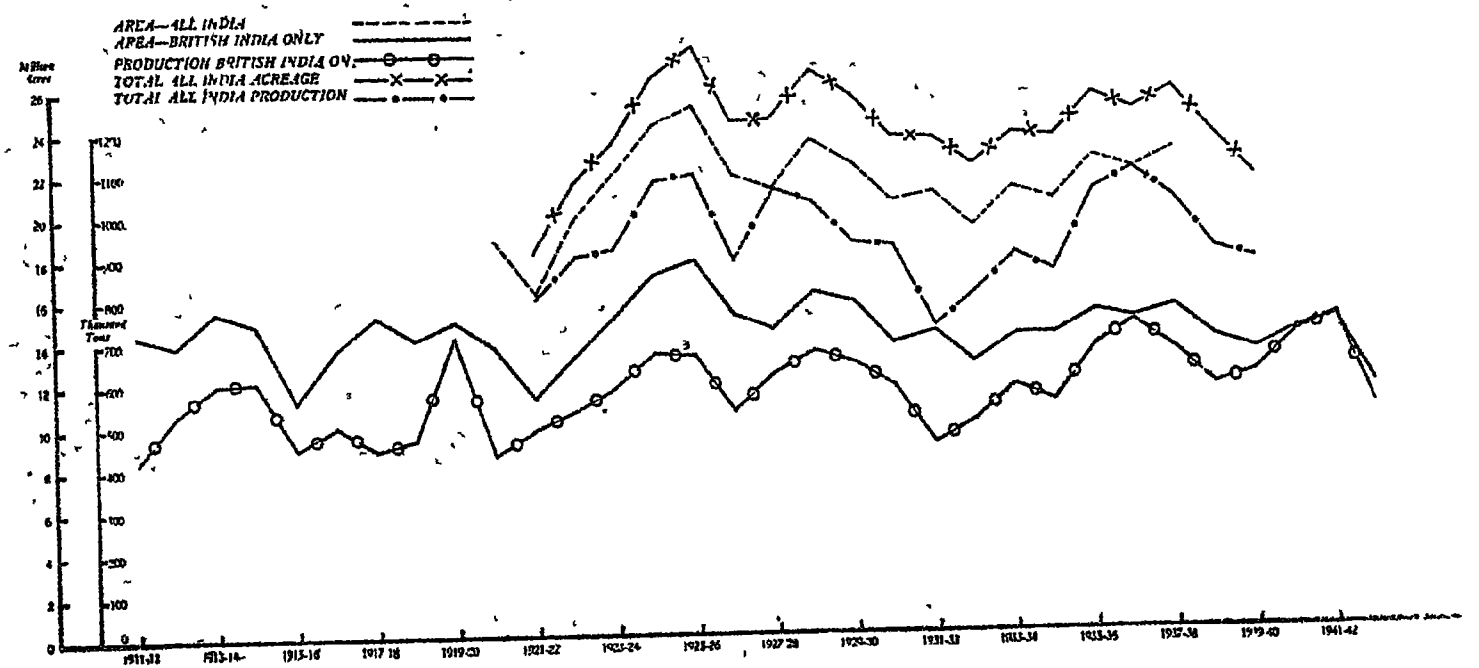
16 ACREAGE UNDER CONDIMENTS AND SPICES IN INDIA



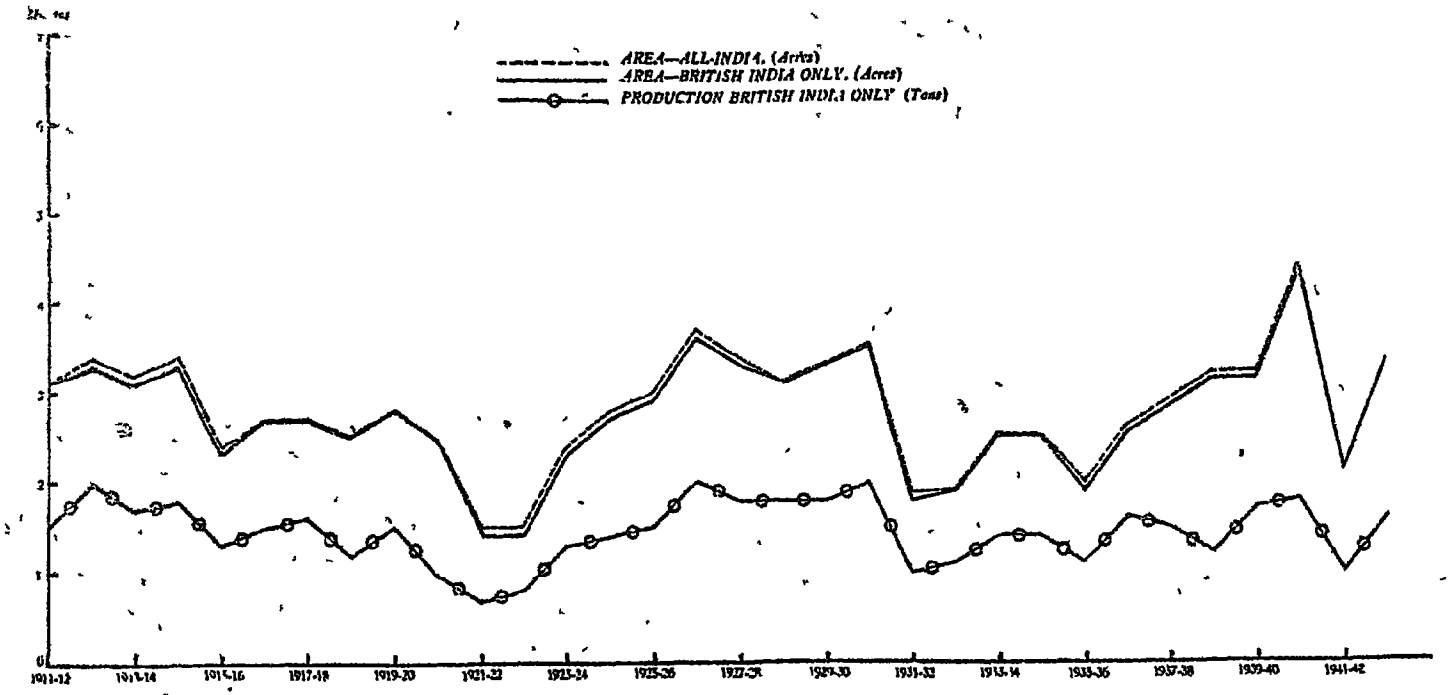
17. ACREAGE & PRODUCTION OF SUGARCANE IN INDIA



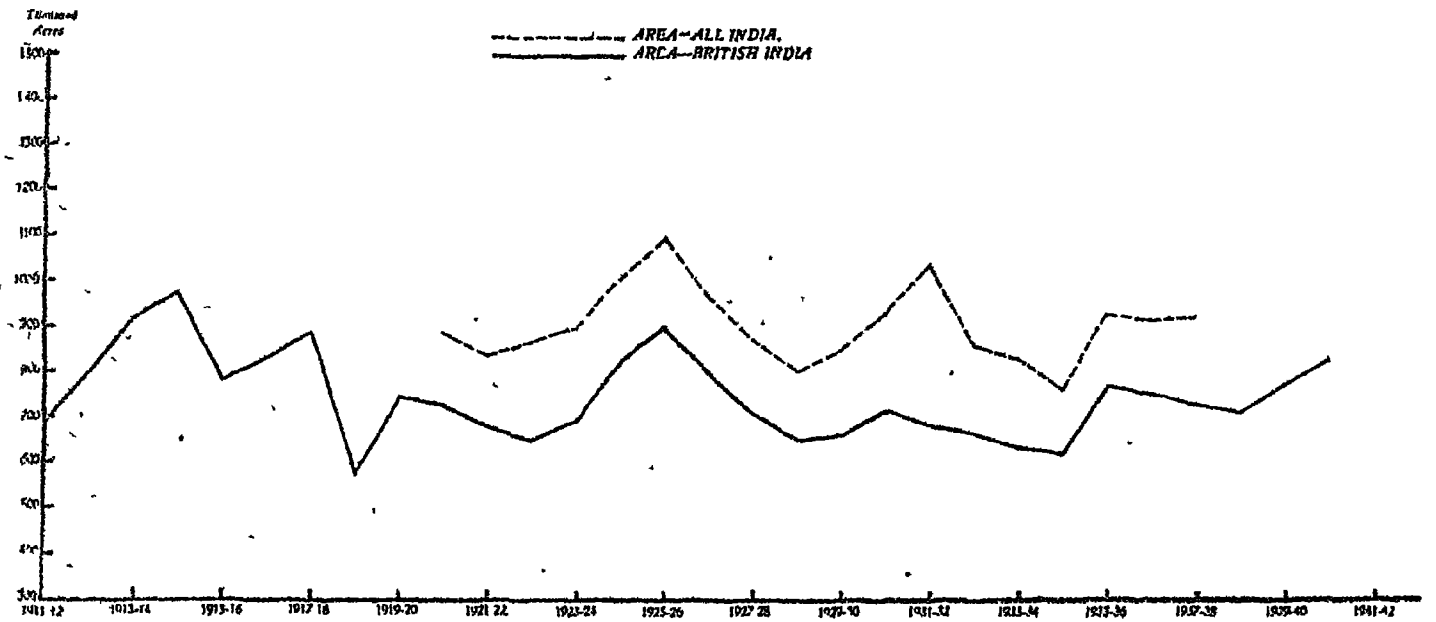
18. ACREAGE & PRODUCTION OF COTTON IN INDIA



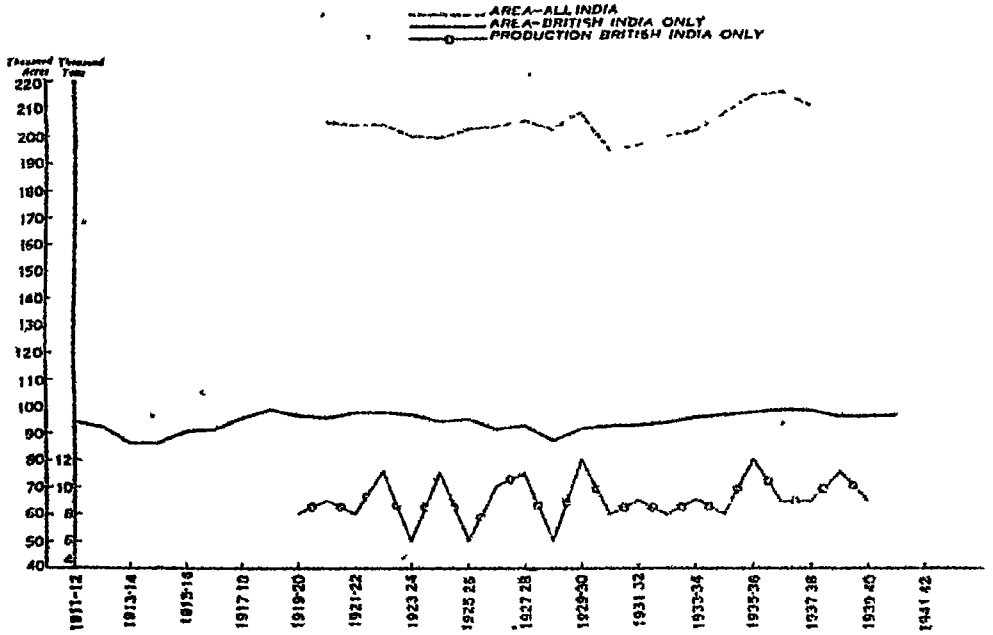
19. ACREAGE & PRODUCTION OF JUTE IN INDIA



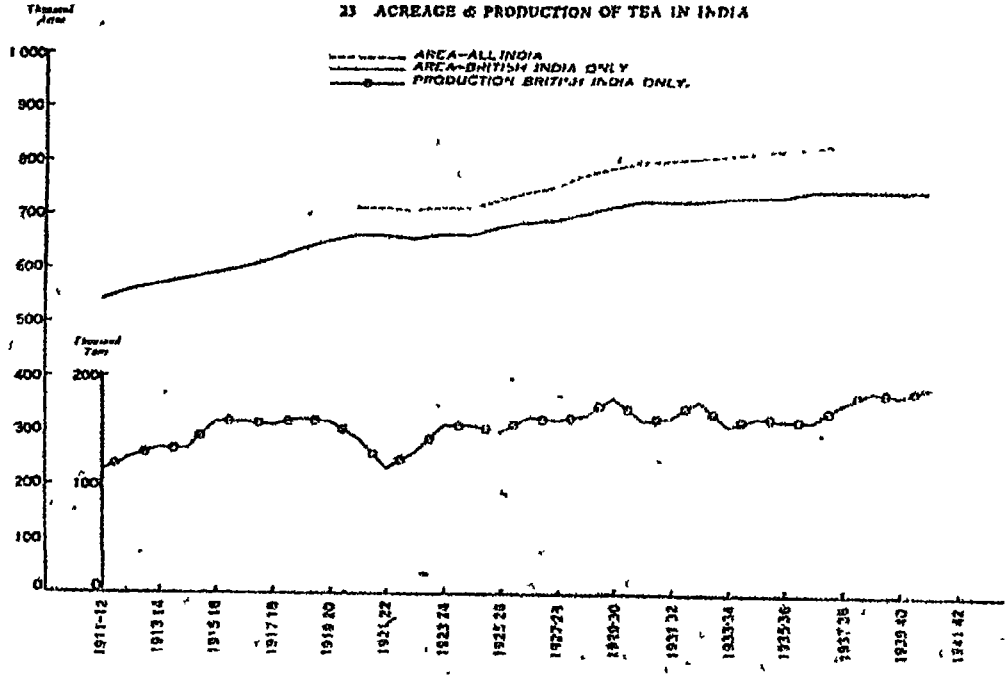
20. ACREAGE UNDER OTHER FIBRES IN INDIA



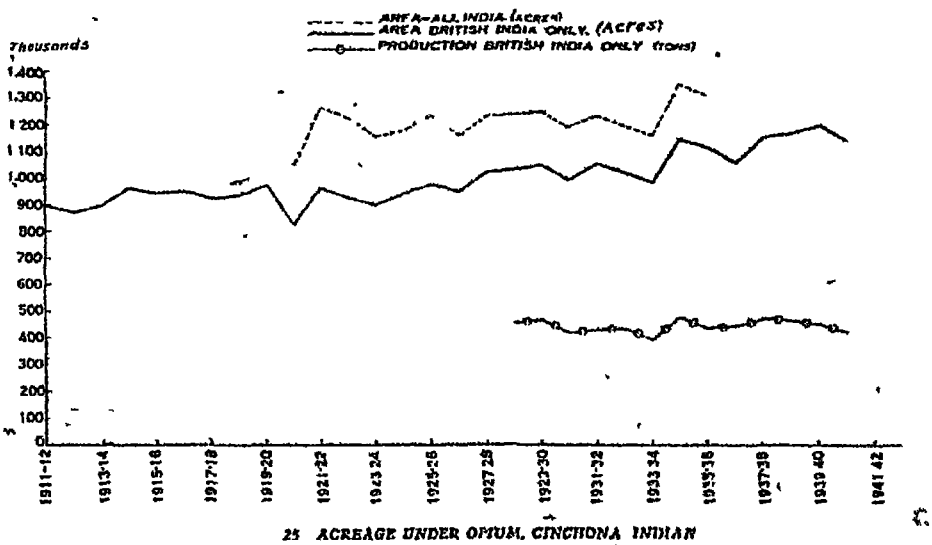
22 ACREAGE & PRODUCTION OF COFFEE IN INDIA*



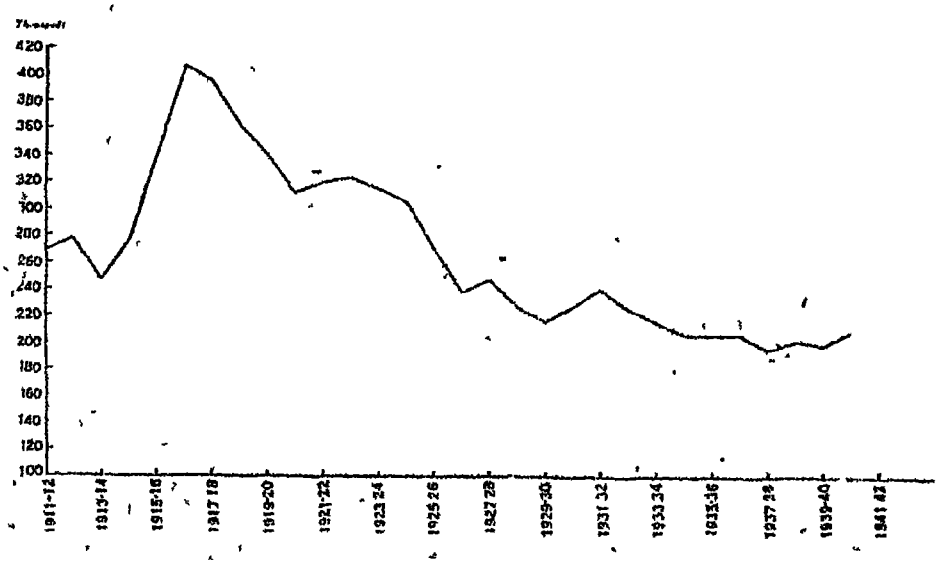
23 ACREAGE & PRODUCTION OF TEA IN INDIA



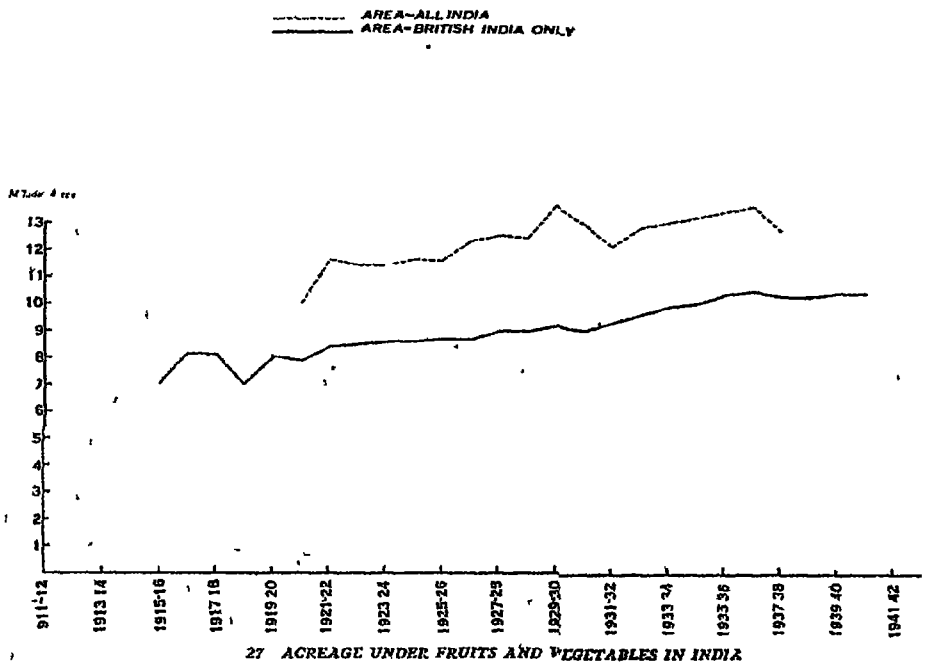
24. ACREAGE & PRODUCTION OF TOBACCO IN INDIA



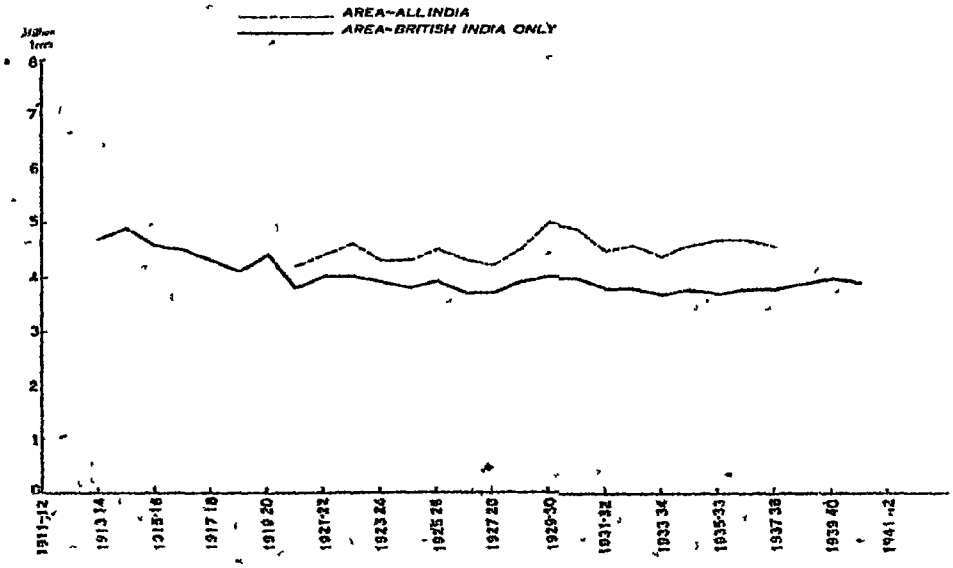
25 ACREAGE UNDER OPIUM, CINCHONA INDIAN HEMP AND OTHER DRUGS AND NARCOTICS IN INDIA



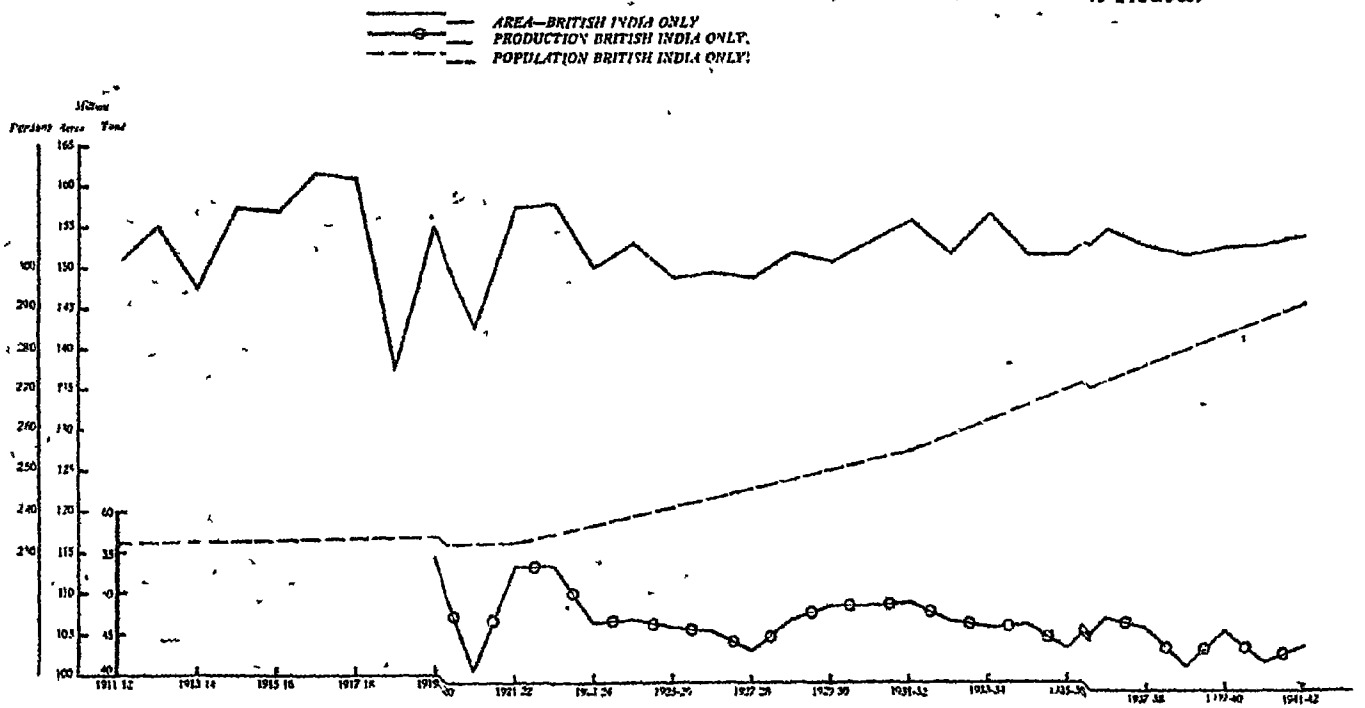
26 ACREAGE UNDER FODDER CROPS IN INDIA



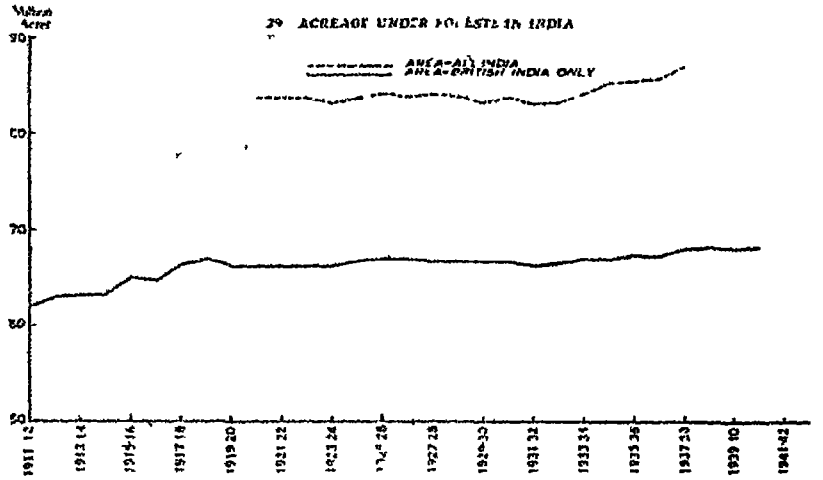
27 ACREAGE UNDER FRUITS AND VEGETABLES IN INDIA



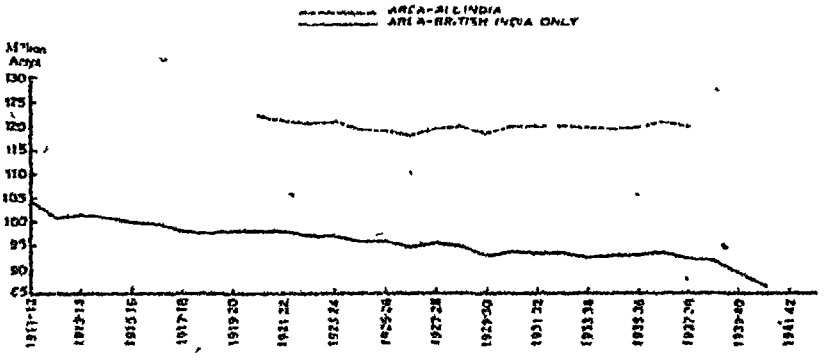
28. TOTAL AREA & TOTAL PRODUCTION OF ALL MAJOR FOOD GRAINS (Rice, Wheat, Barley, Jowar, Bajra, Maize & Gram) In British India.



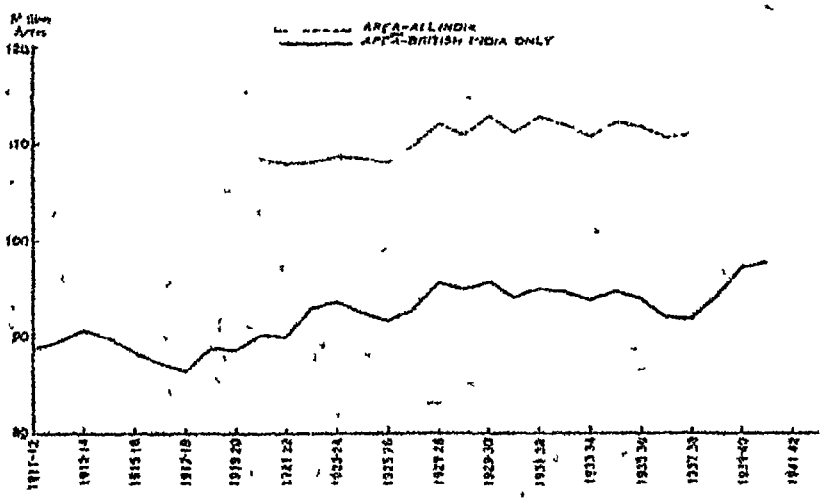
29 ACREAGE UNDER FOREST IN INDIA



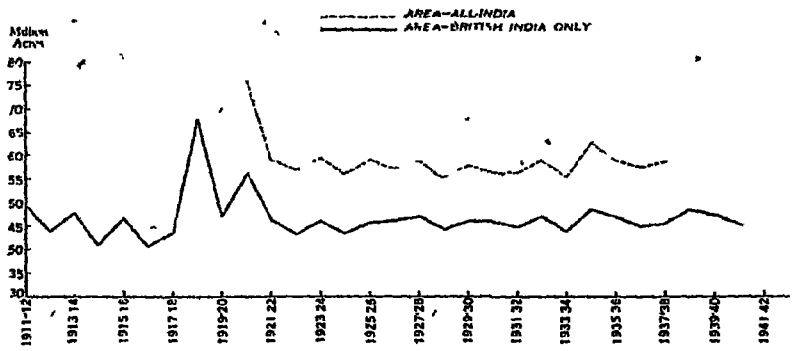
30 AREA NOT AVAILABLE FOR CULTIVATION IN INDIA



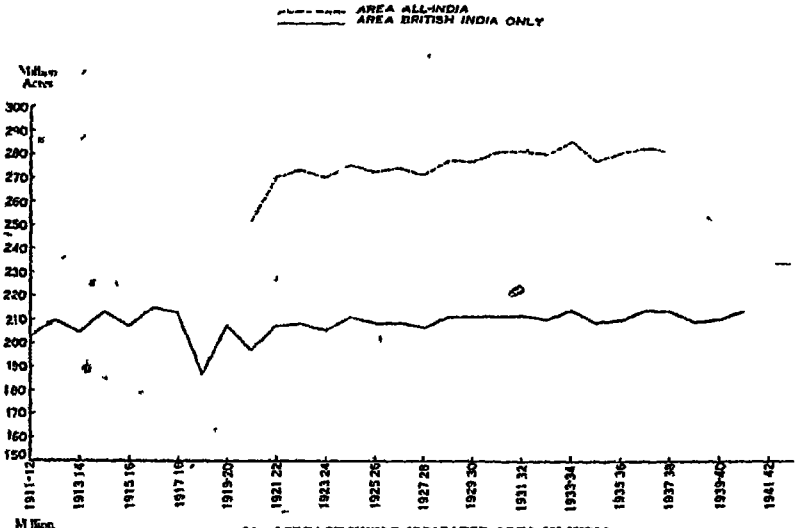
31 ACREAGE UNDER CULTURABLE WASTE OTHER THAN FALLOW IN INDIA



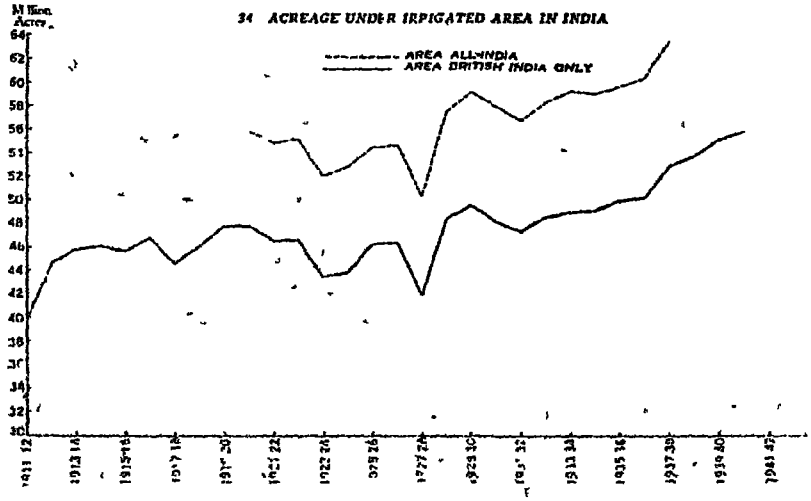
32 ACREAGE UNDER CURRENT FALLOWS IN INDIA



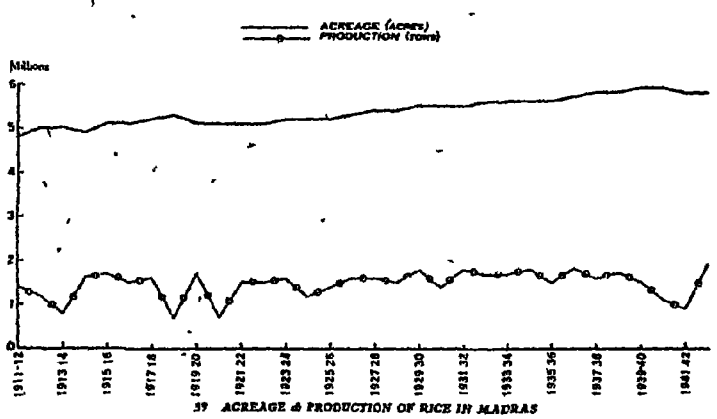
33 ACREAGE UNDER NET AREA SOWN IN INDIA



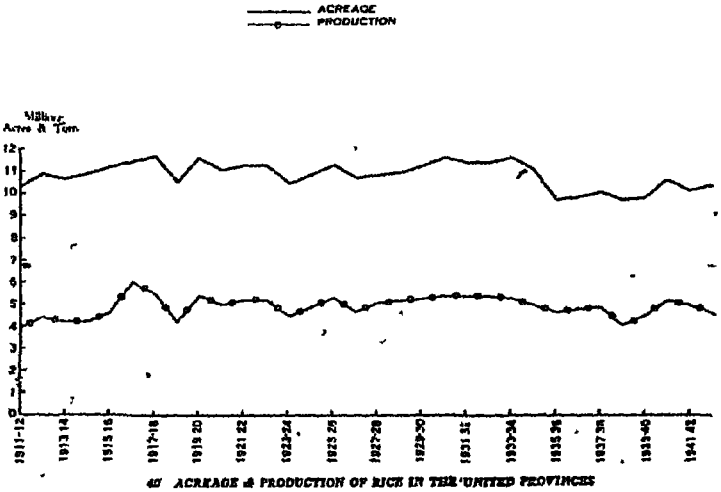
34 ACREAGE UNDER IRRIGATED AREA IN INDIA



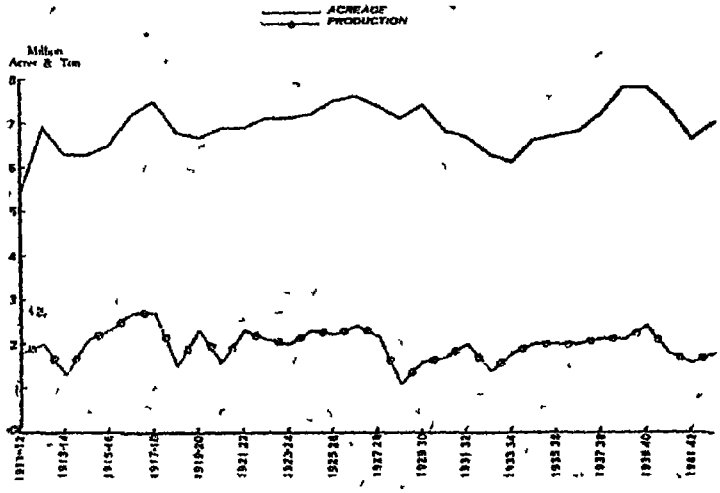
38 ACREAGE & PRODUCTION OF RICE IN THE CENTRAL PROVINCES AND BERAR



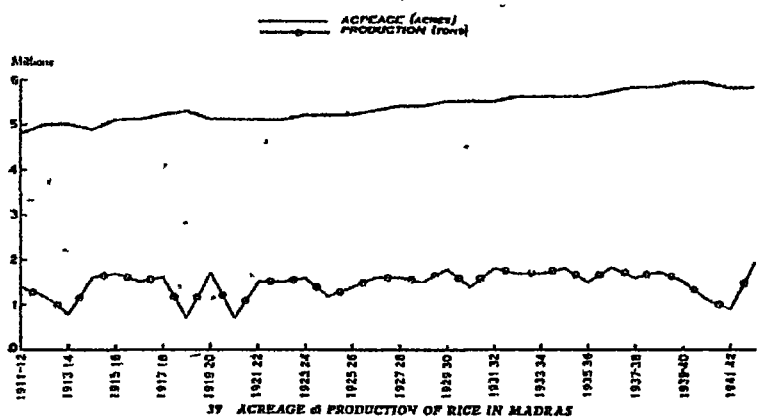
39 ACREAGE & PRODUCTION OF RICE IN MADRAS



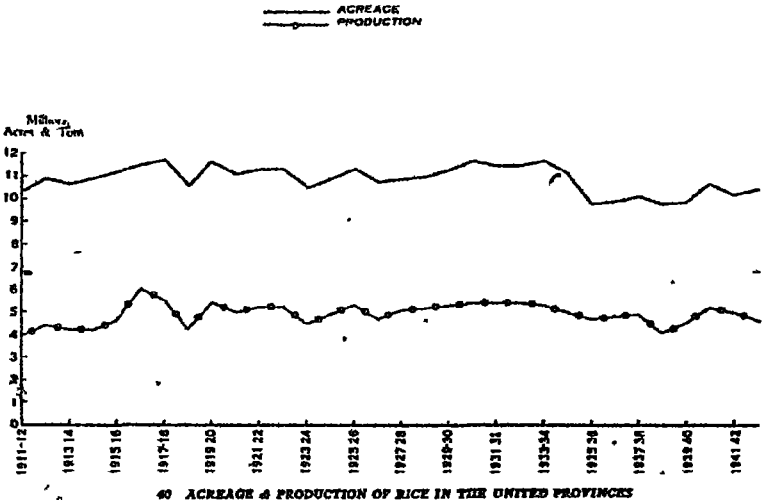
40 ACREAGE & PRODUCTION OF RICE IN THE UNITED PROVINCES



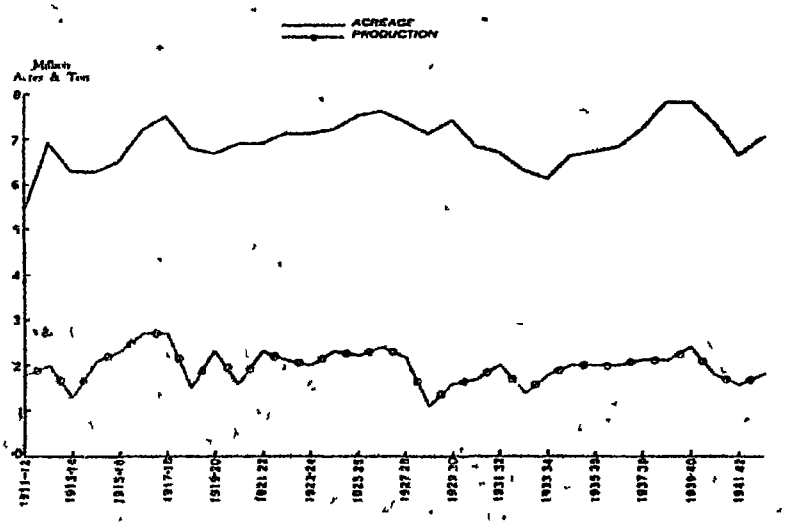
38 ACREAGE & PRODUCTION OF RICE IN THE CENTRAL PROVINCES AND BERAR



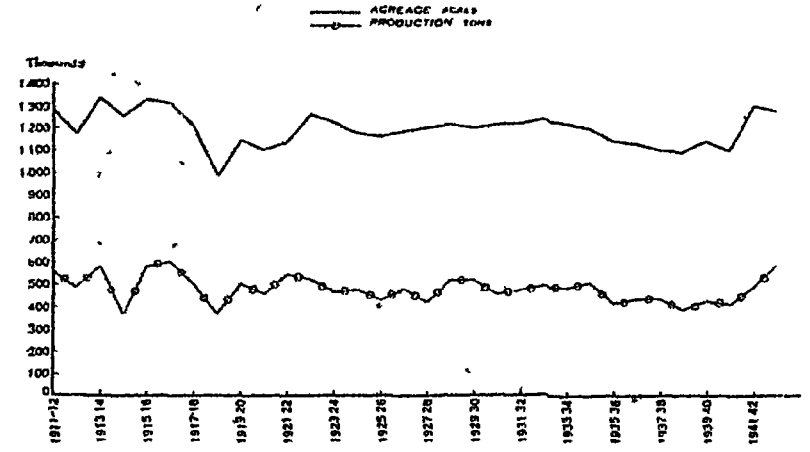
39 ACREAGE & PRODUCTION OF RICE IN MADRAS



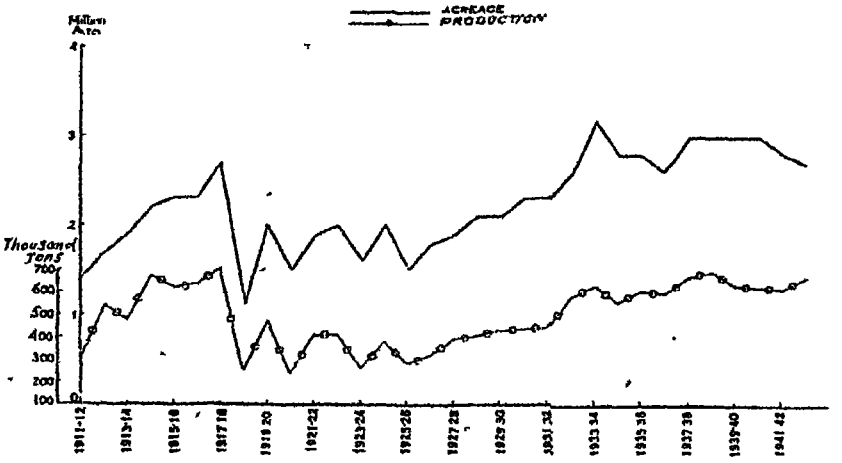
40 ACREAGE & PRODUCTION OF RICE IN THE UNITED PROVINCES



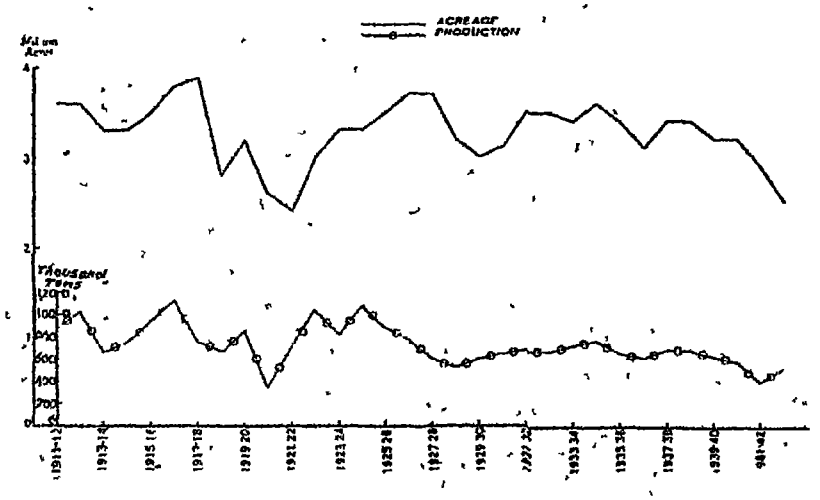
41 ACREAGE & PRODUCTION OF WHEAT IN BIHAR AND ORISSA



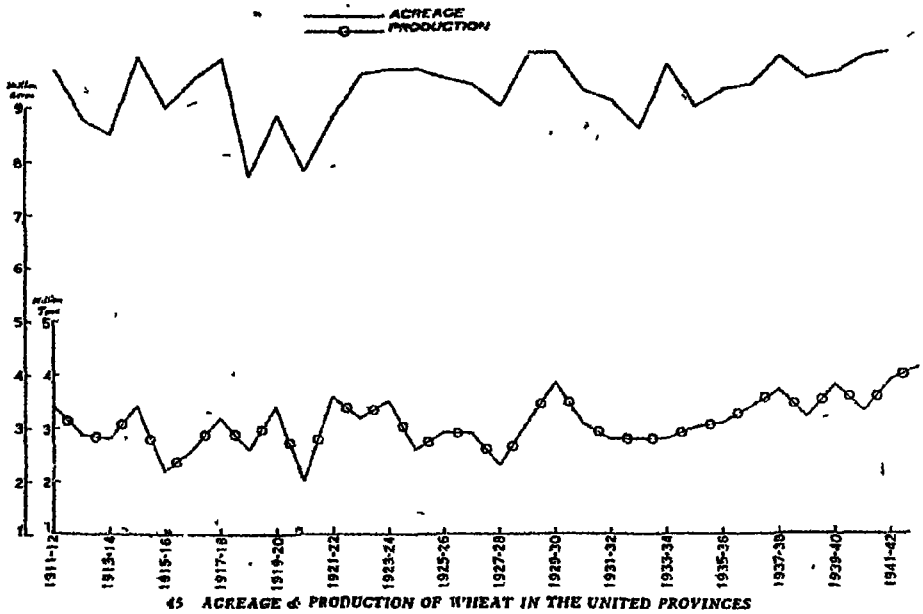
42 ACREAGE & PRODUCTION OF WHEAT IN BOMBAY INCLUDING SIND



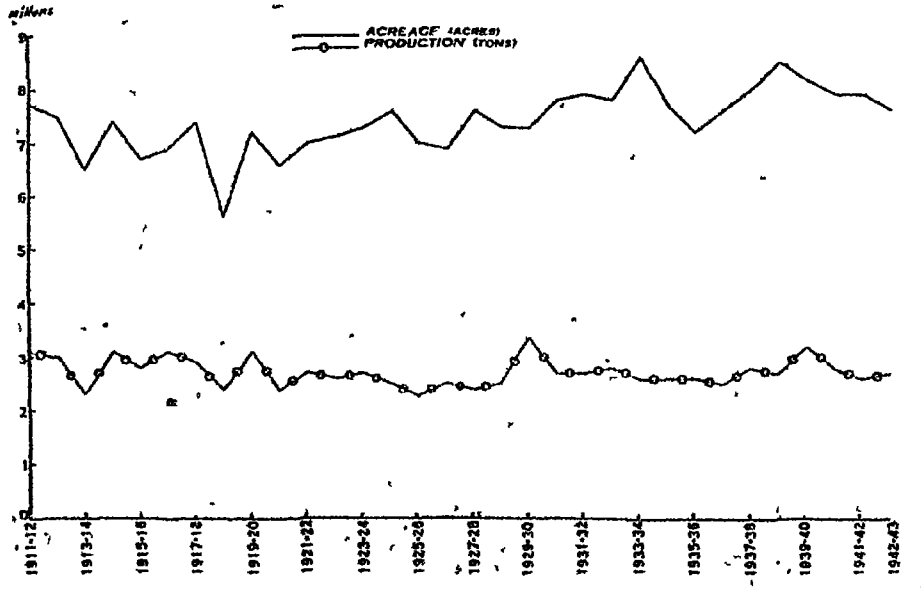
43 ACREAGE & PRODUCTION OF WHEAT IN THE CENTRAL PROVINCES AND BERAR



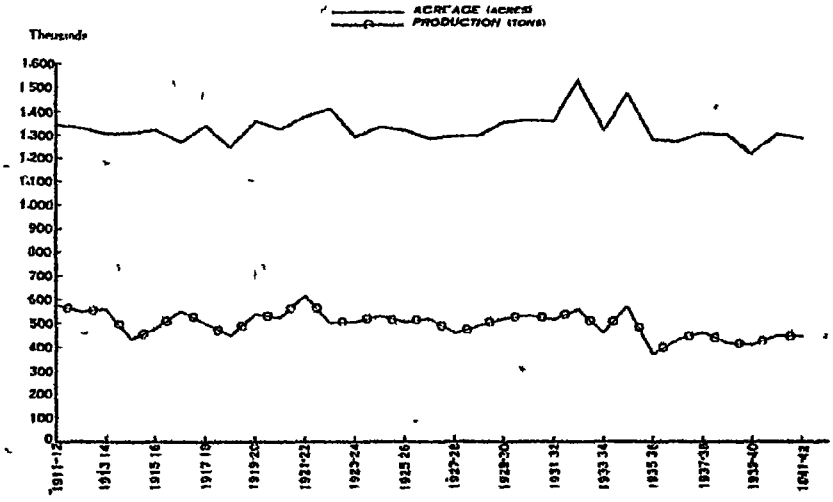
44 ACREAGE & PRODUCTION OF WHEAT IN THE PUNJAB



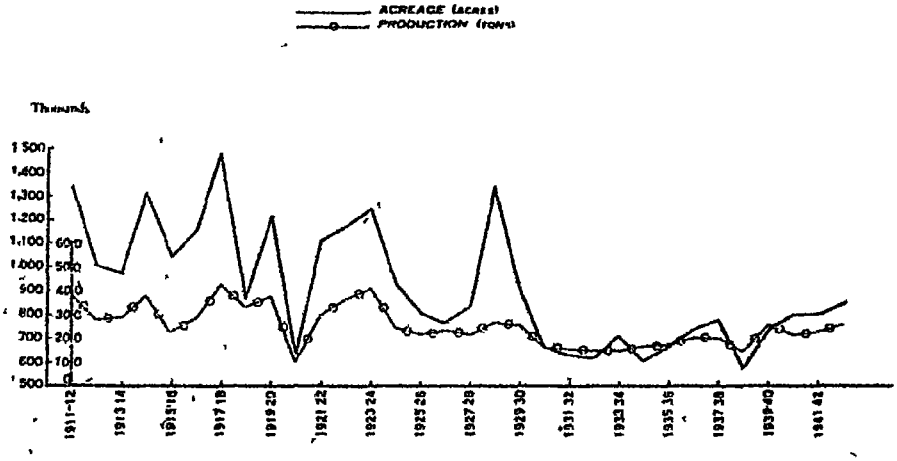
45 ACREAGE & PRODUCTION OF WHEAT IN THE UNITED PROVINCES



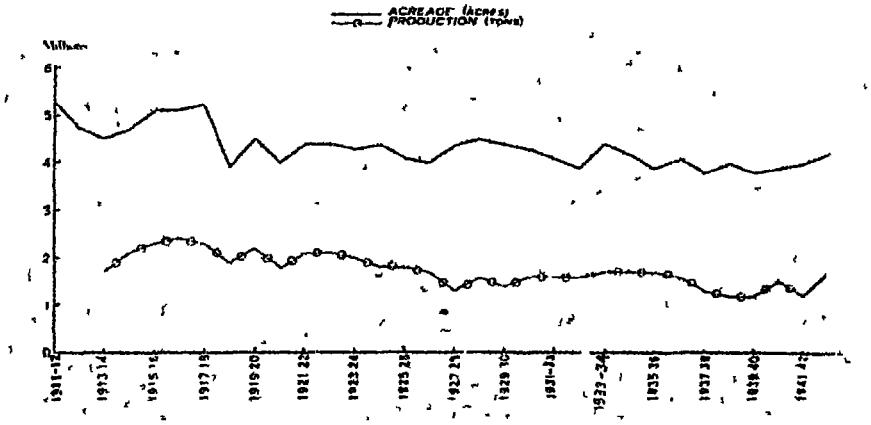
46. ACREAGE & PRODUCTION OF BARLEY IN BIHAR AND ORISSA



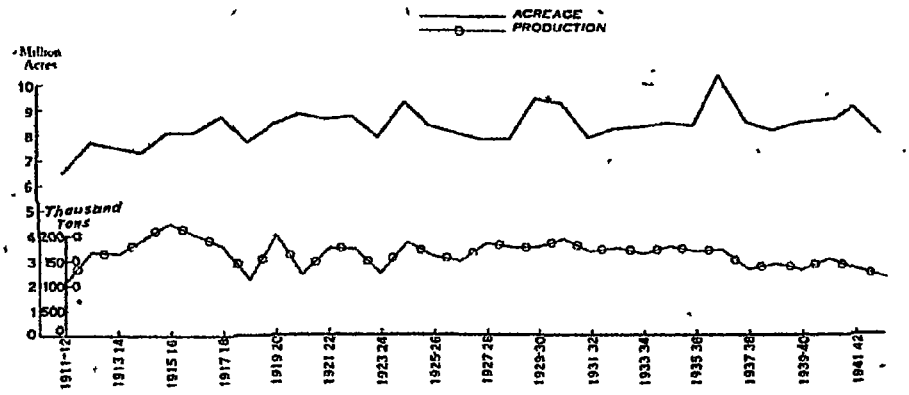
47. ACREAGE & PRODUCTION OF BARLEY IN THE PUNJAB



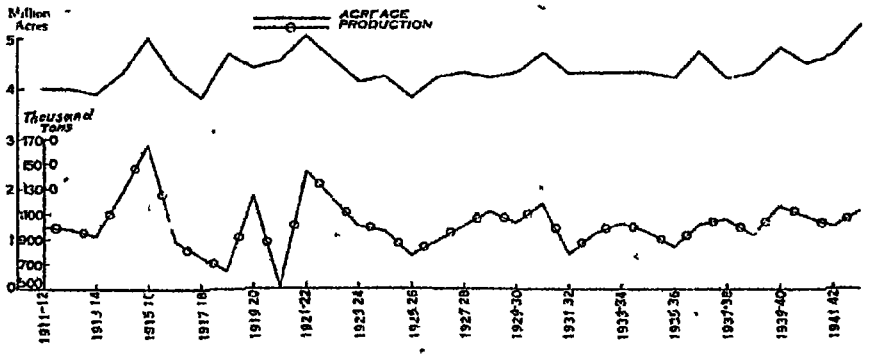
48 ACREAGE & PRODUCTION OF BARLEY IN THE UNITED PROVINCES



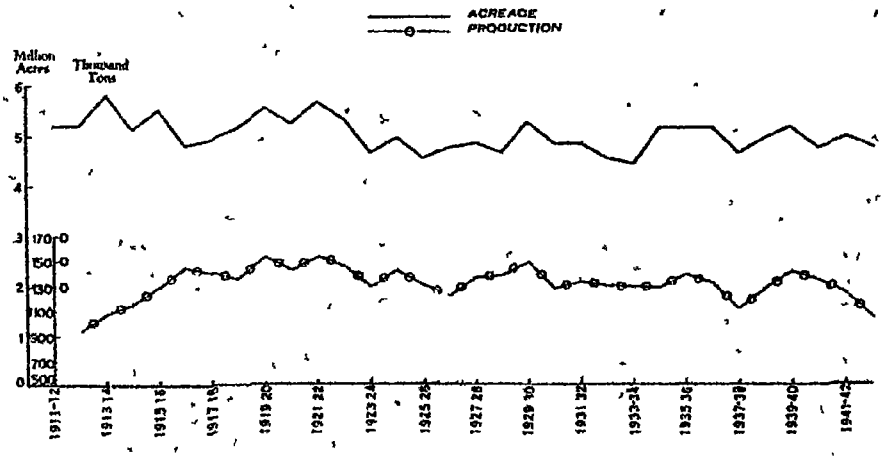
49 ACREAGE & PRODUCTION OF JOWAR IN BOMBAY INCLUDING SIND



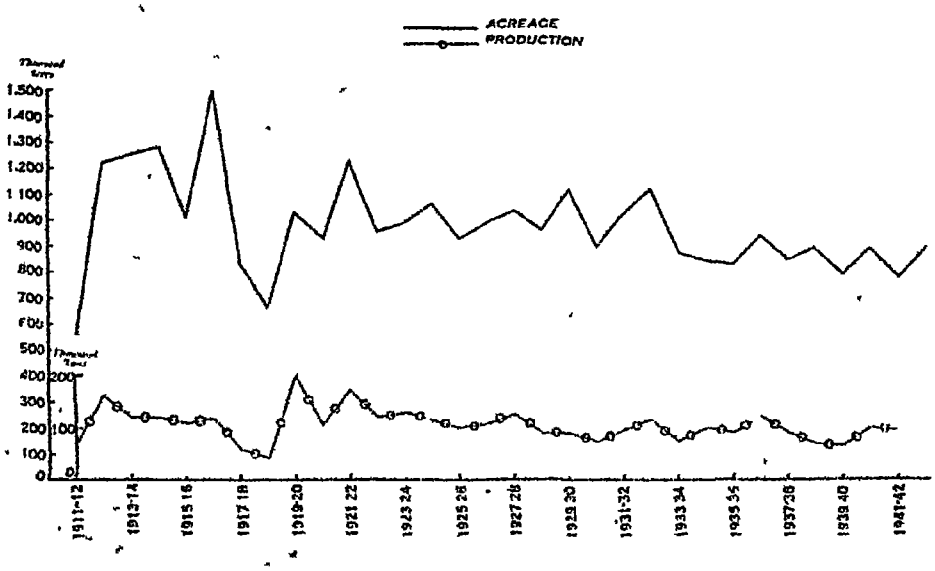
50 ACREAGE & PRODUCTION OF JOWAR IN THE CENTRAL PROVINCES AND BERAR



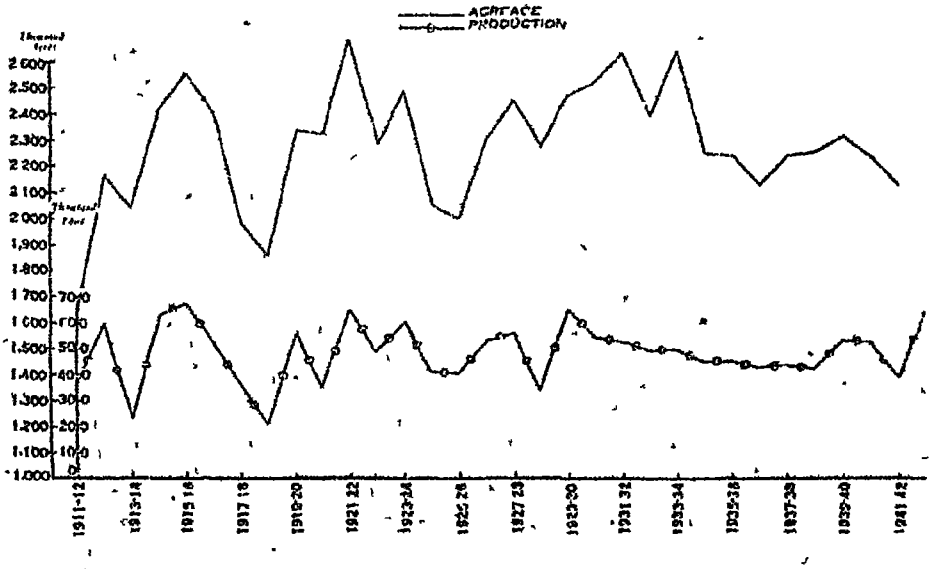
51 ACREAGE & PRODUCTION OF JOWAR IN MADRAS



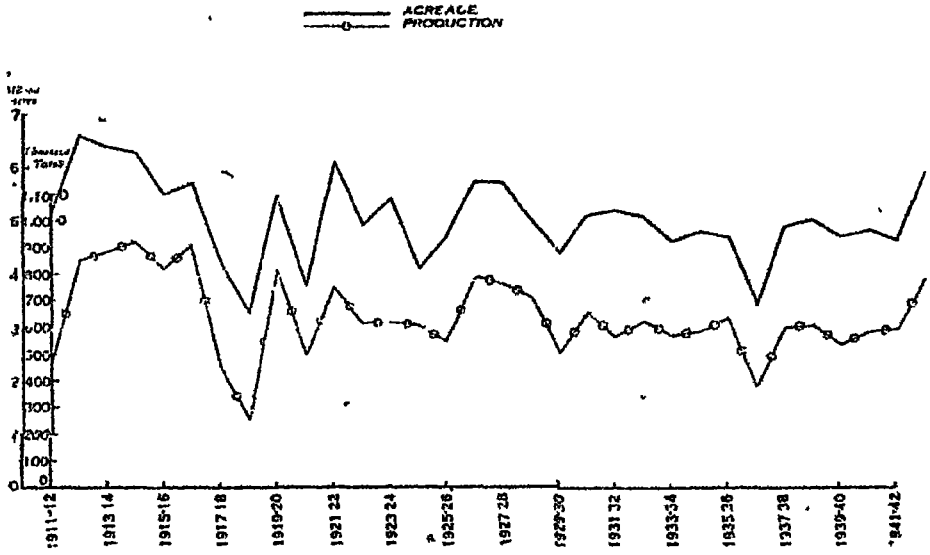
52 ACREAGE & PRODUCTION OF JOWAR IN THE PUNJAB



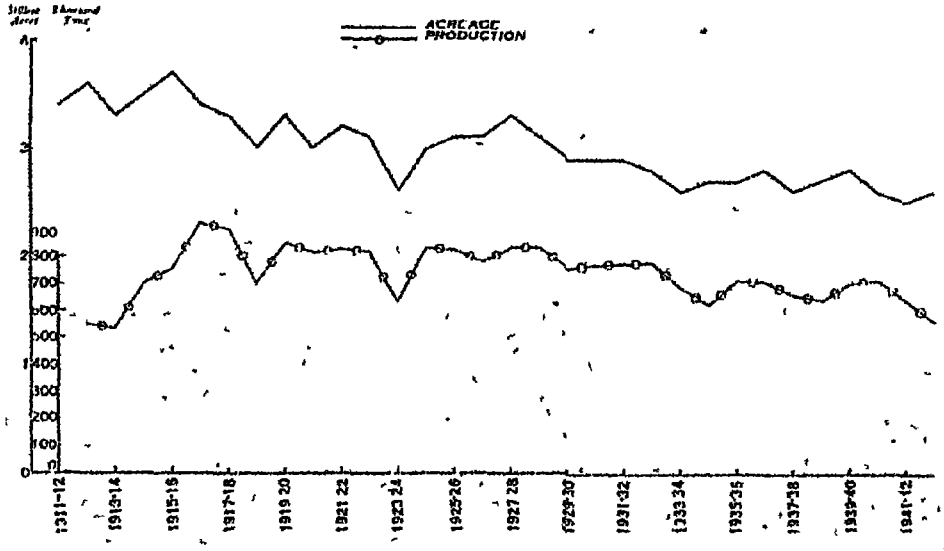
53 ACREAGE & PRODUCTION OF JOWAR IN THE UNITED PROVINCES



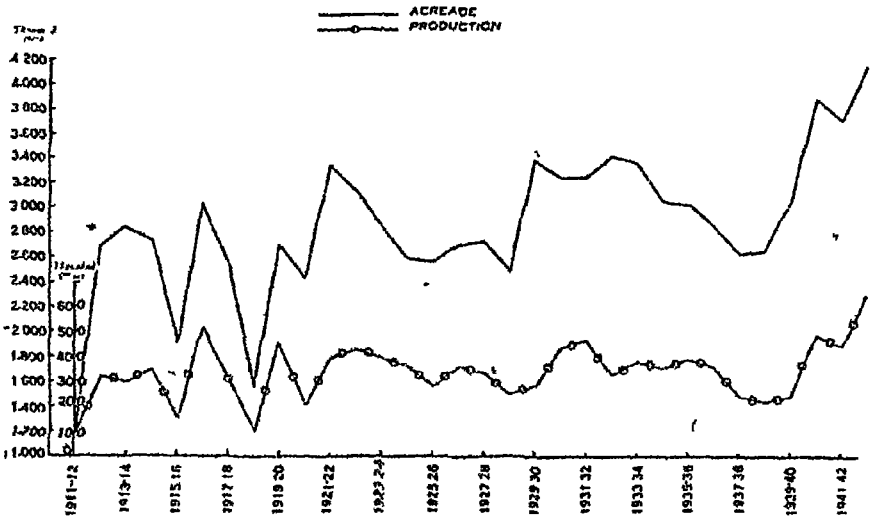
54 ACREAGE & PRODUCTION OF BAJRA IN BOMBAY INCLUDING SIND



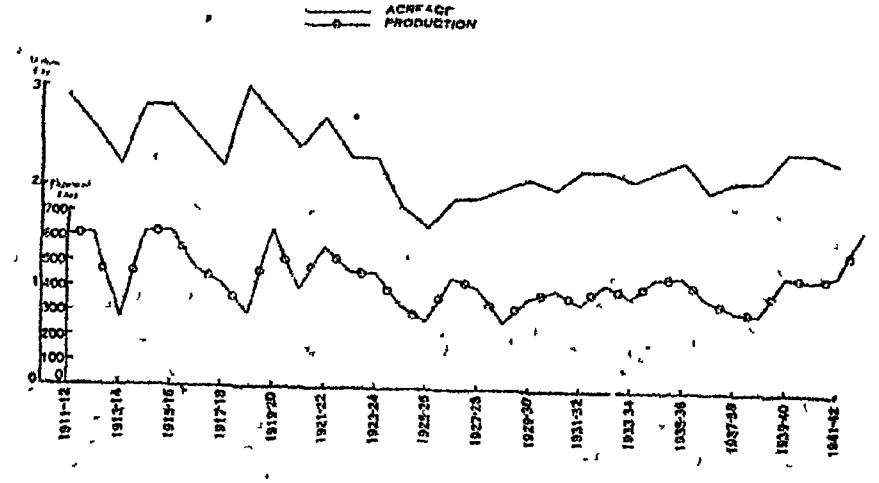
55 ACREAGE & PRODUCTION OF BAJRA IN MADRAS



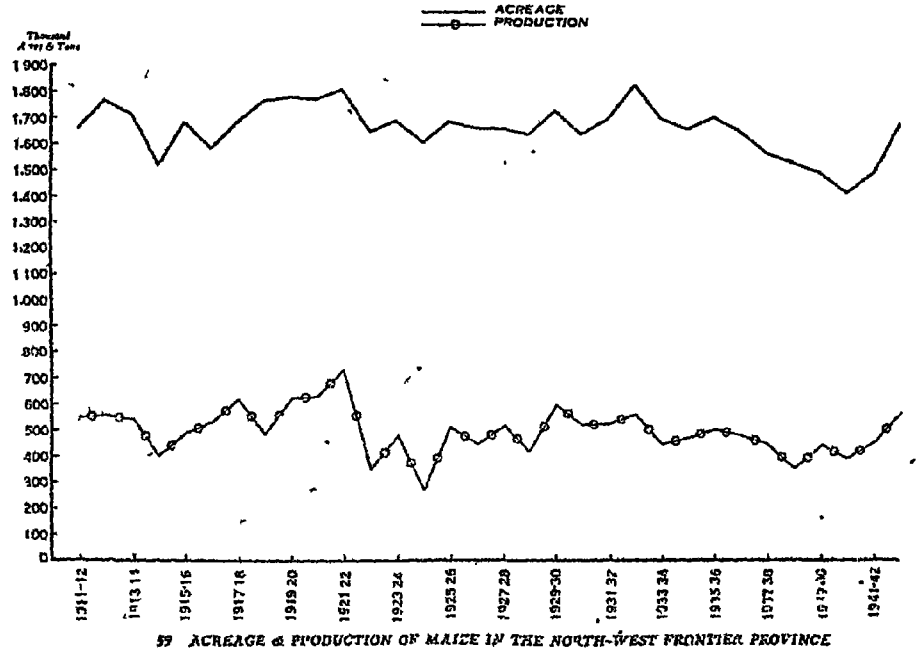
56 ACREAGE & PRODUCTION OF BAJRA IN THE PUNJAB



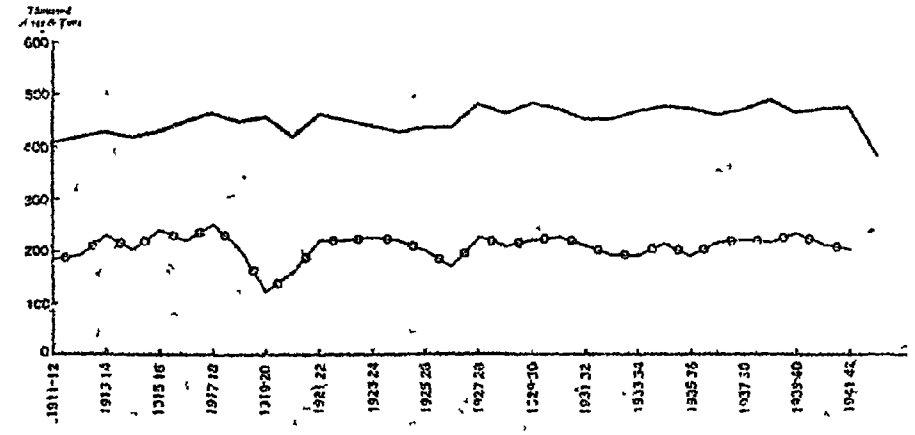
57. ACREAGE & PRODUCTION OF BAJRA IN THE UNITED PROVINCES



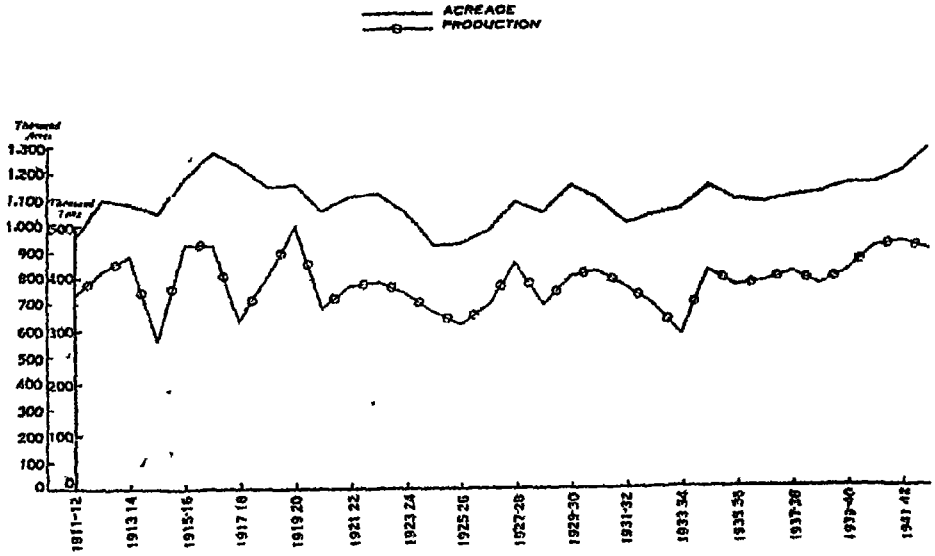
58 ACREAGE & PRODUCTION OF MAIZE IN BIHAR AND ORISSA



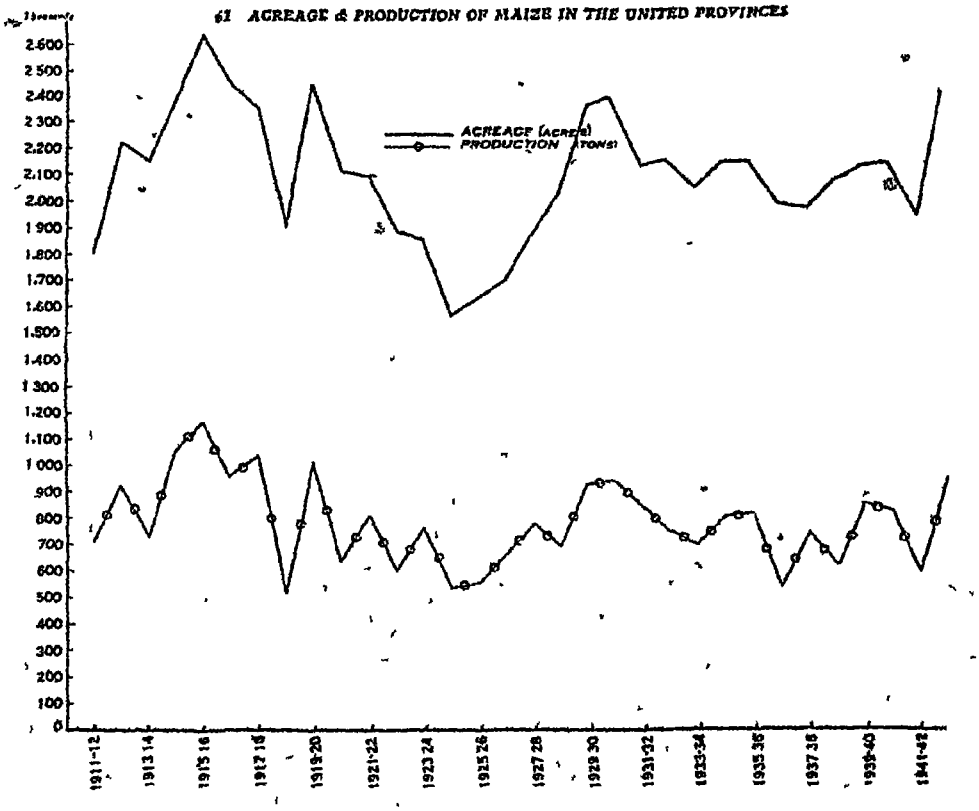
59 ACREAGE & PRODUCTION OF MAIZE IN THE NORTH-WEST FRONTIER PROVINCE



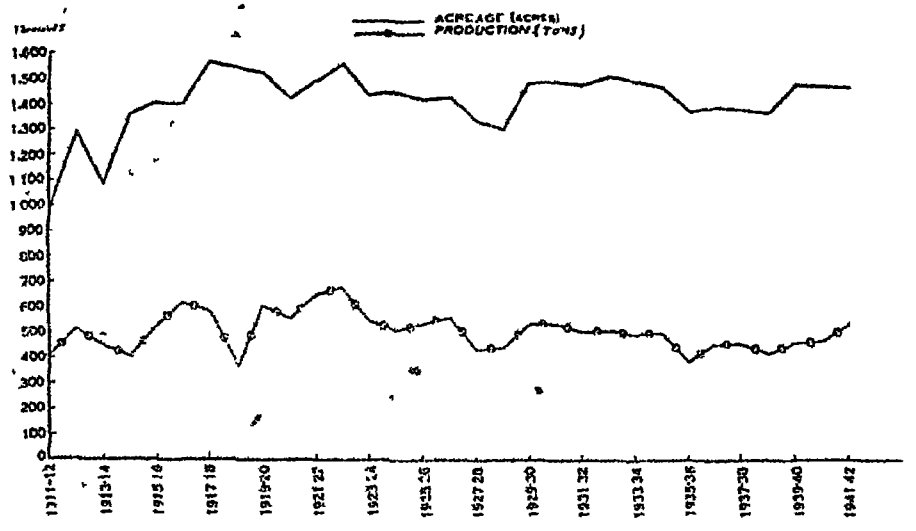
60 ACREAGE & PRODUCTION OF MAIZE IN THE PUNJAB



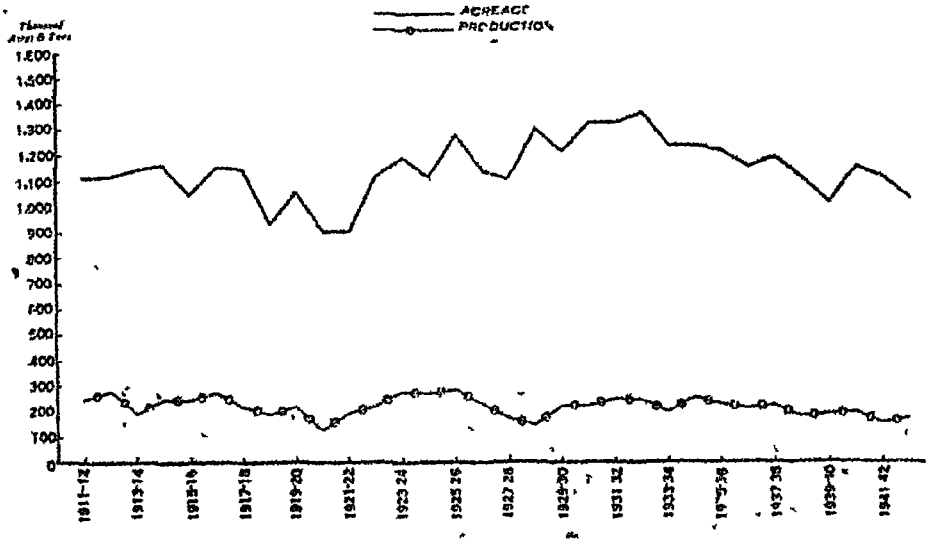
61 ACREAGE & PRODUCTION OF MAIZE IN THE UNITED PROVINCES



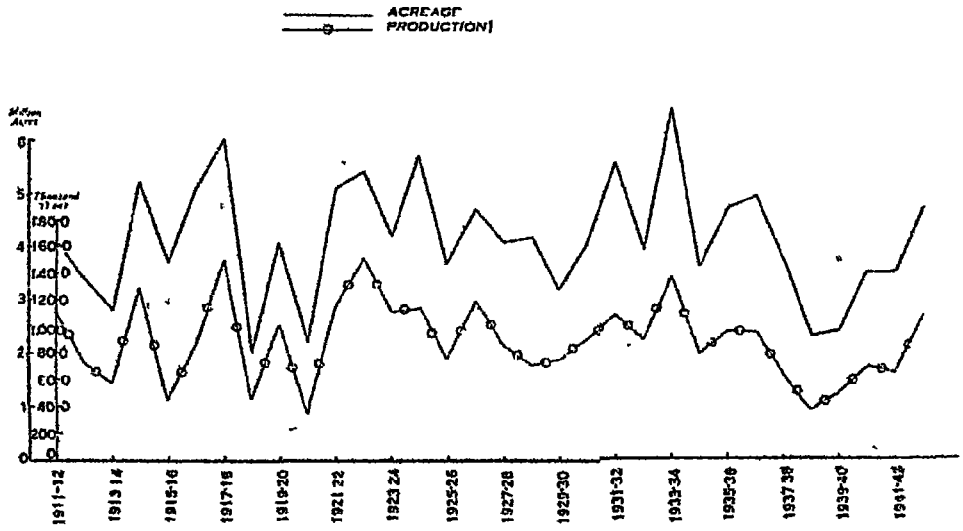
62. ACREAGE & PRODUCTION OF GRAM IN BIHAR AND ORISSA



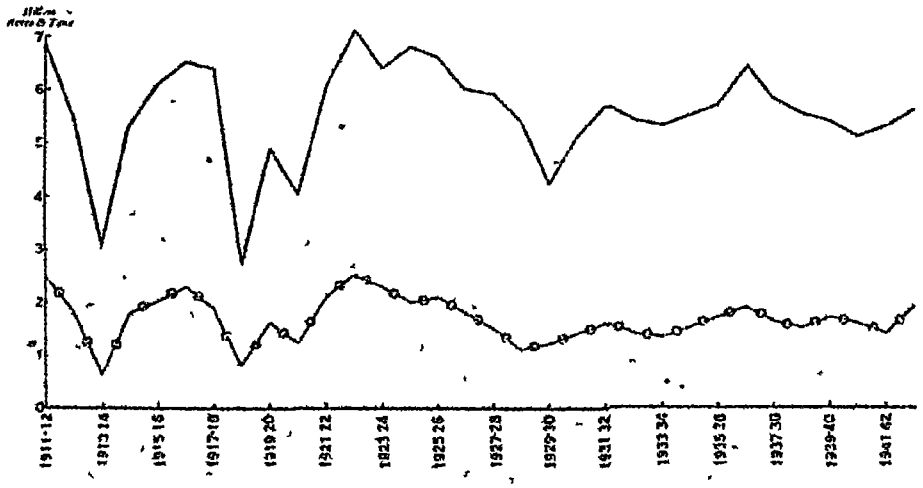
63. ACREAGE & PRODUCTION OF GRAM IN THE CENTRAL PROVINCES AND BERAR



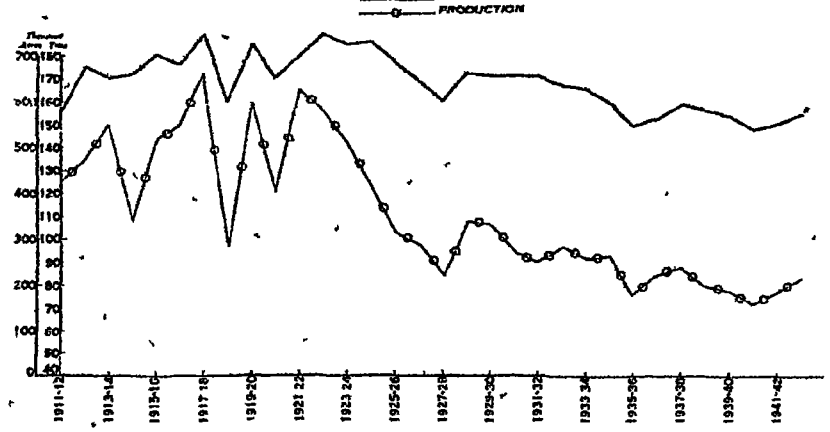
'64 ACREAGE & PRODUCTION OF GRAM IN THE PUNJAB



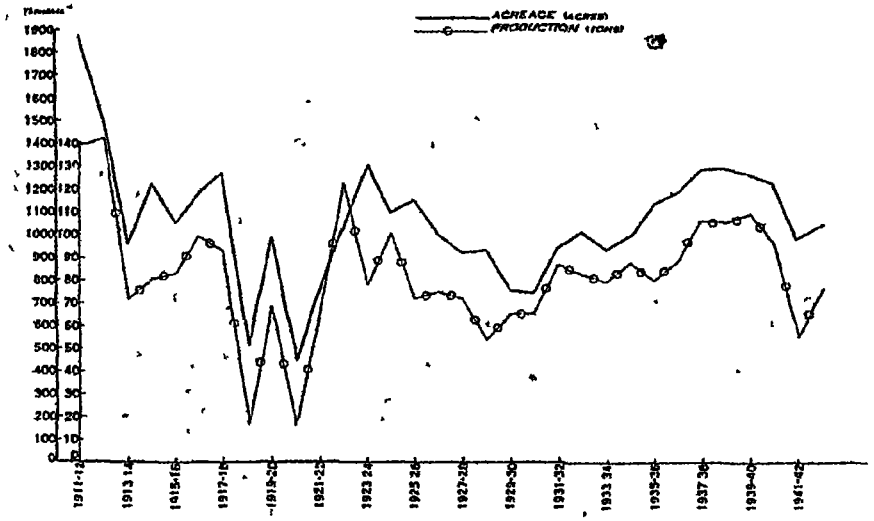
3E & PRODUCTION OF GRAM IN THE UNITED PROVINCES



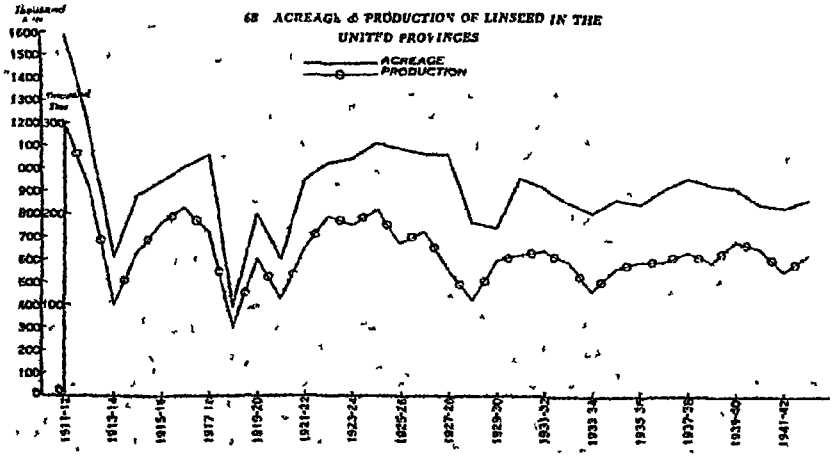
66 ACREAGE & PRODUCTION OF LINSEED IN BIHAR AND ORISSA

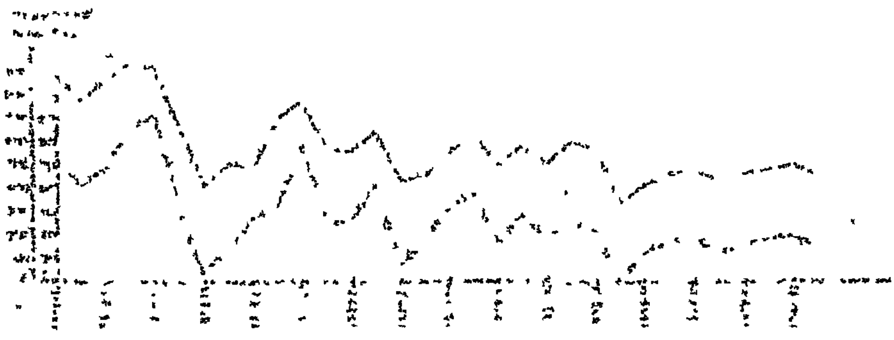


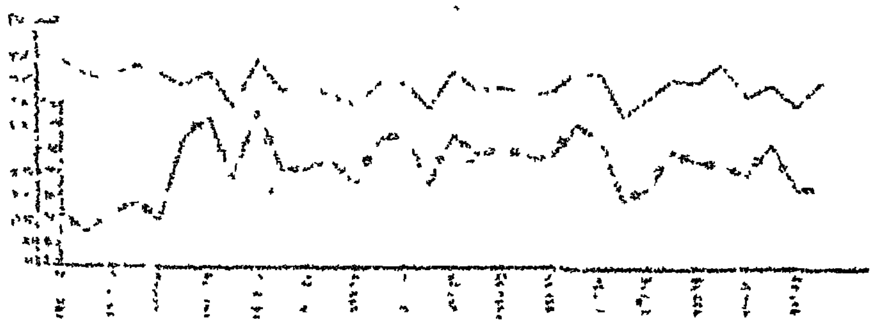
67 ACREAGE & PRODUCTION OF LINSEED IN THE CENTRAL PROVINCES AND BERAR

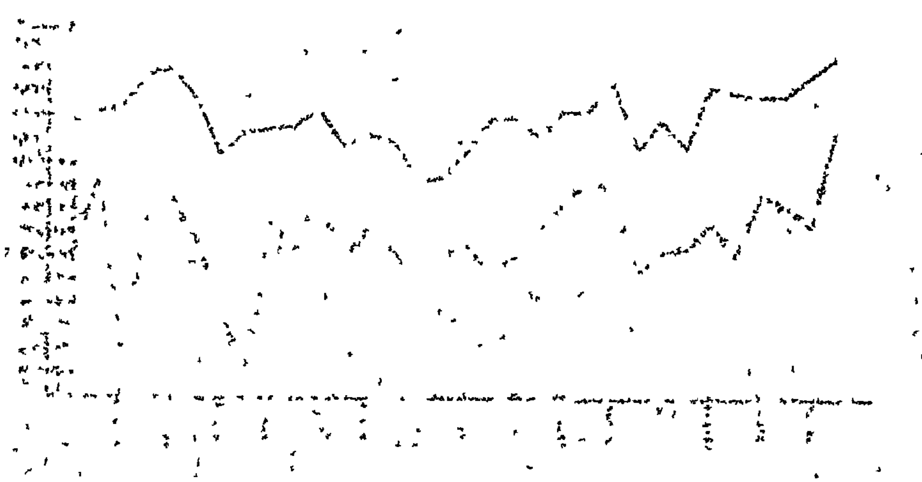


68 ACREAGE & PRODUCTION OF LINSEED IN THE UNITED PROVINCES

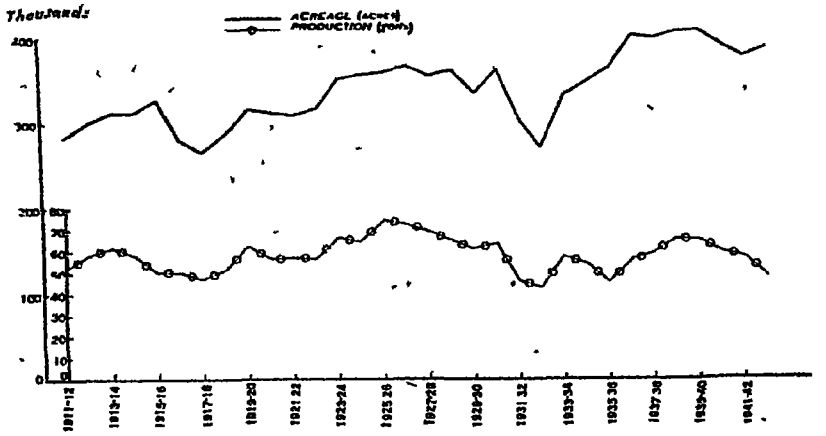




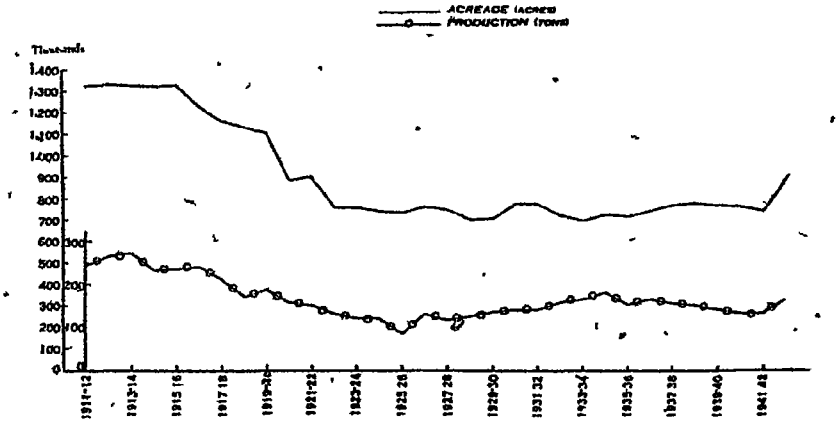




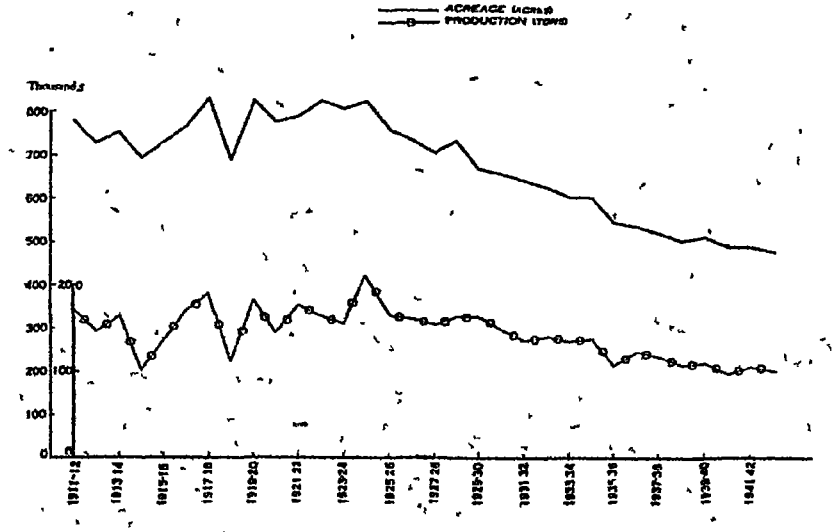
72. ACREAGE & PRODUCTION OF RAPE AND MUSTARD IN ASSAM



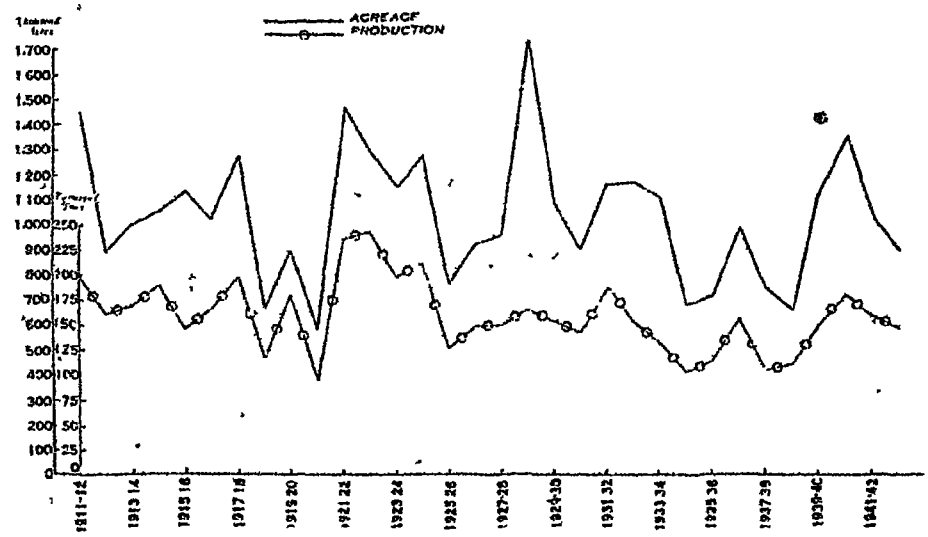
73 ACREAGE & PRODUCTION OF RAPE AND MUSTARD IN BENGAL



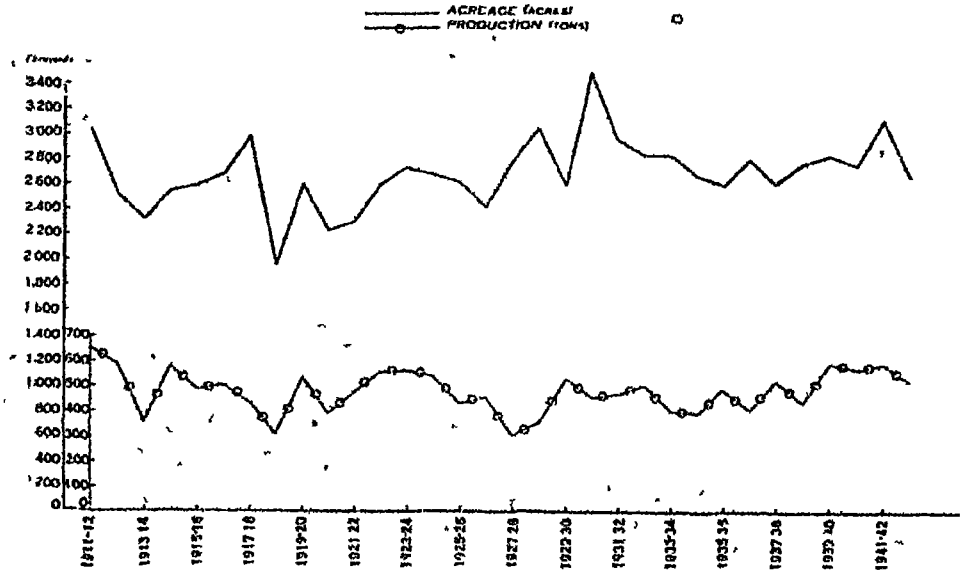
74 ACREAGE & PRODUCTION OF RAPE AND MUSTARD IN BIHAR AND ORISSA



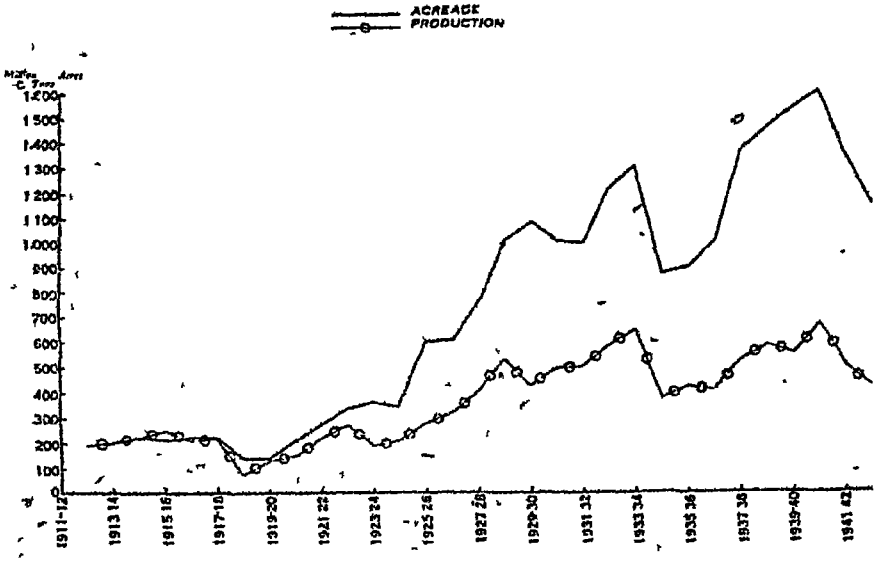
75 ACREAGE & PRODUCTION OF RAPE AND MUSTARD IN THE PUNJAB



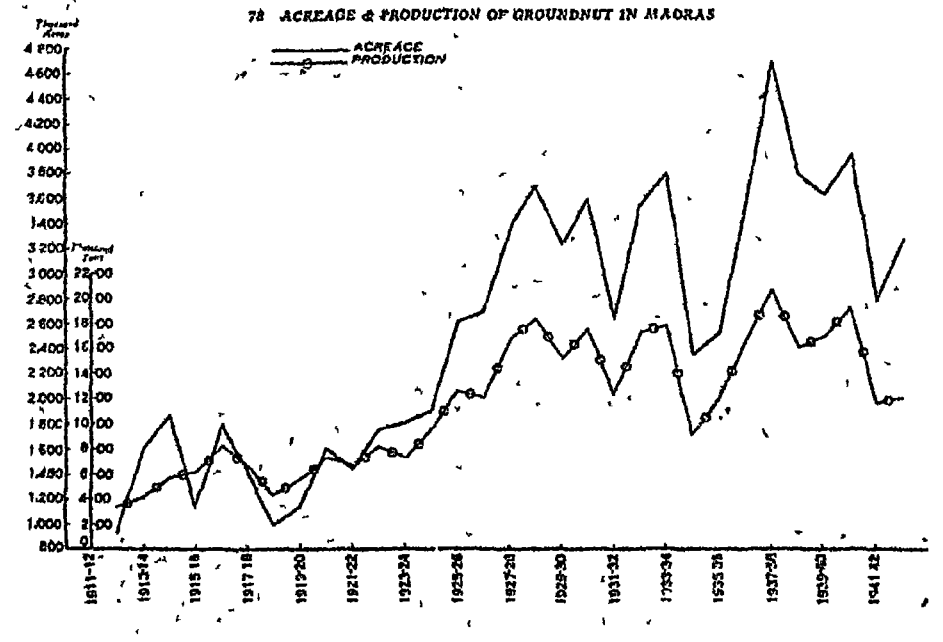
76 ACREAGE & PRODUCTION OF RAPE AND MUSTARD IN THE UNITED PROVINCES



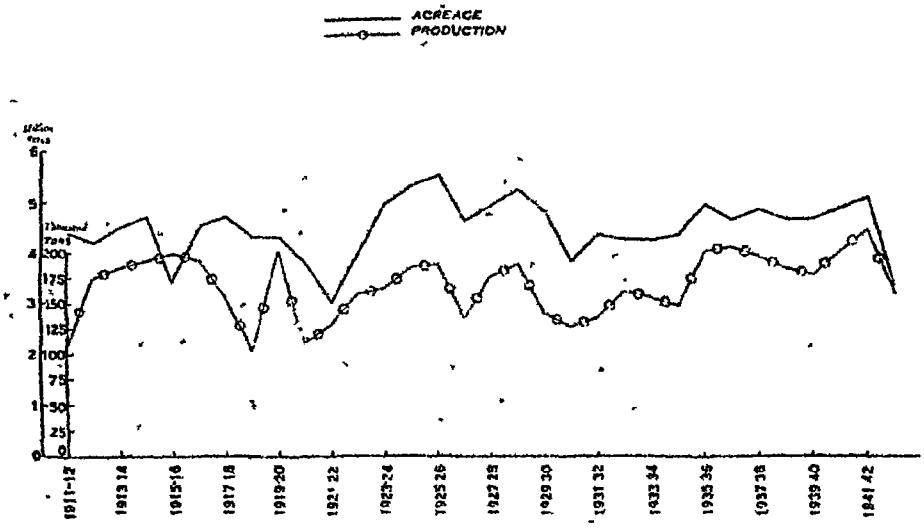
77 ACREAGE & PRODUCTION OF GROUNDNUT IN BOMBAY AND SIND



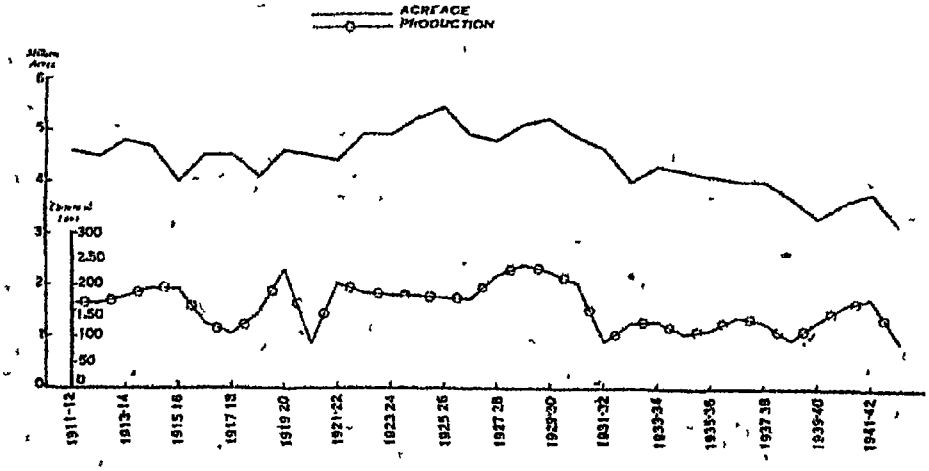
78 ACREAGE & PRODUCTION OF GROUNDNUT IN MADRAS



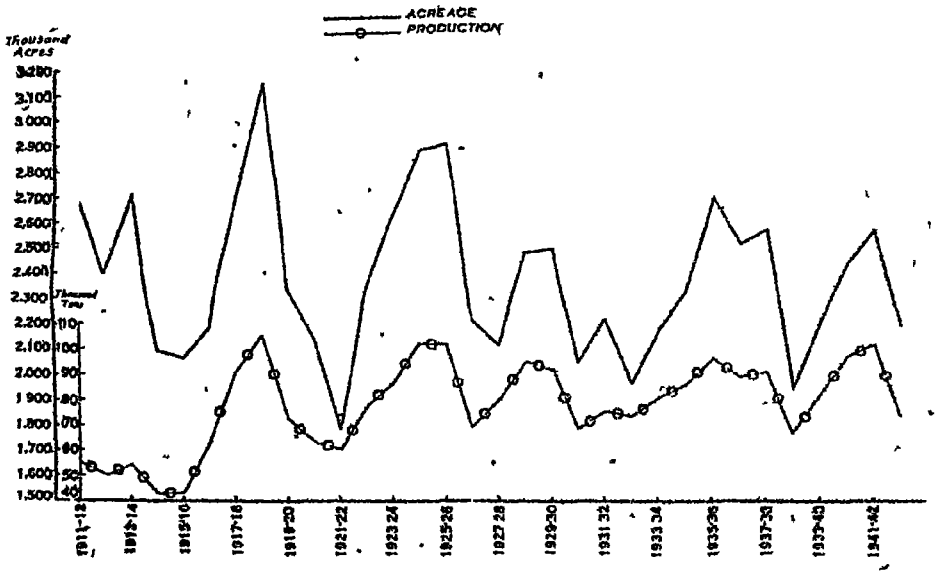
79 ACREAGE & PRODUCTION OF COTTON IN BOMBAY INCLUDING SIND



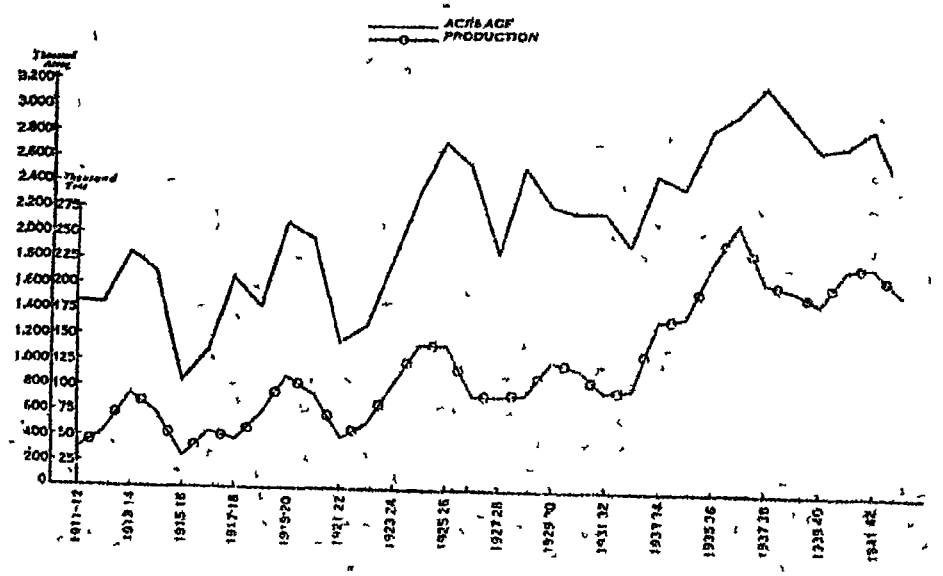
80 ACREAGE & PRODUCTION OF COTTON IN THE CENTRAL PROVINCES AND BERAR



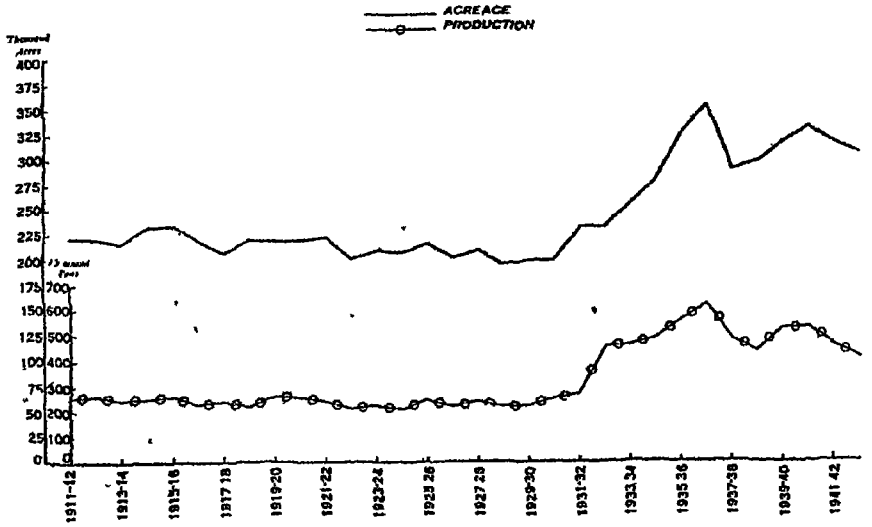
81 ACREAGE & PRODUCTION OF COTTON IN MADRAS



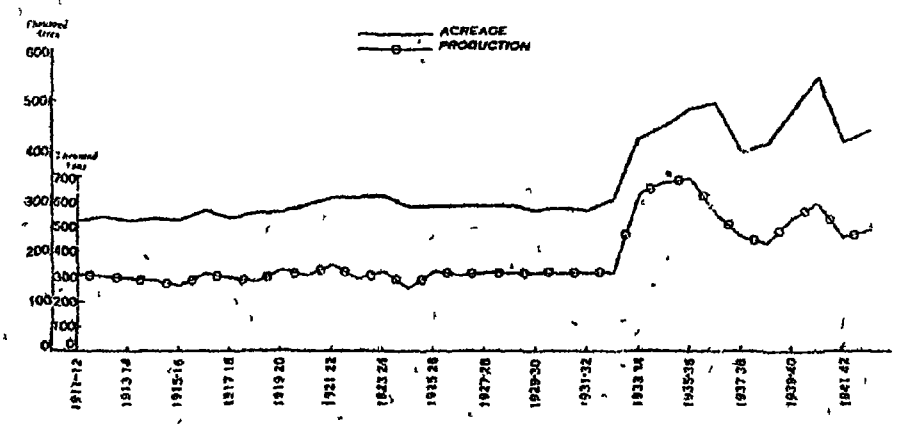
82. ACREAGE & PRODUCTION OF COTTON IN THE PUNJAB



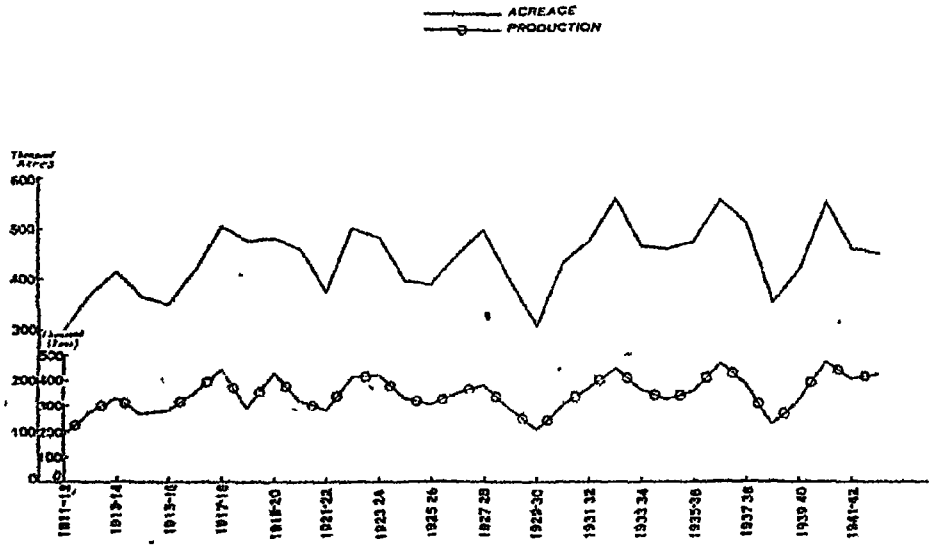
83 ACREAGE & PRODUCTION OF SUGARCANE IN BENGAL



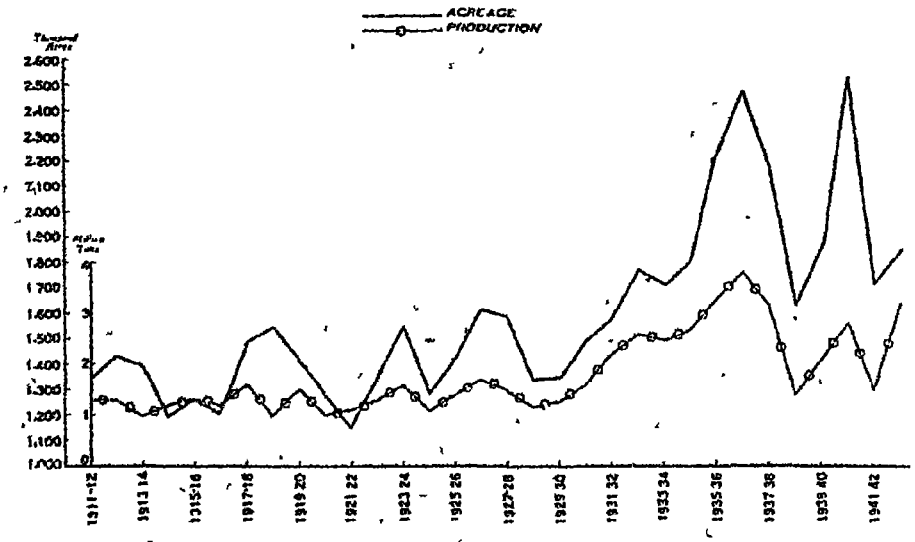
84 ACREAGE & PRODUCTION OF SUGARCANE IN BIHAR AND ORISSA



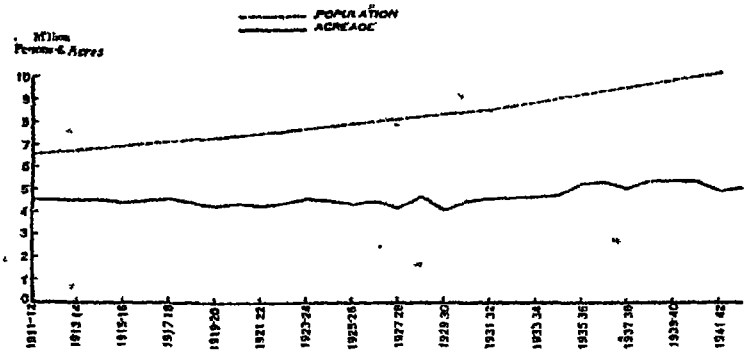
85 ACREAGE & PRODUCTION OF SUGARCANE IN THE PUNJAB



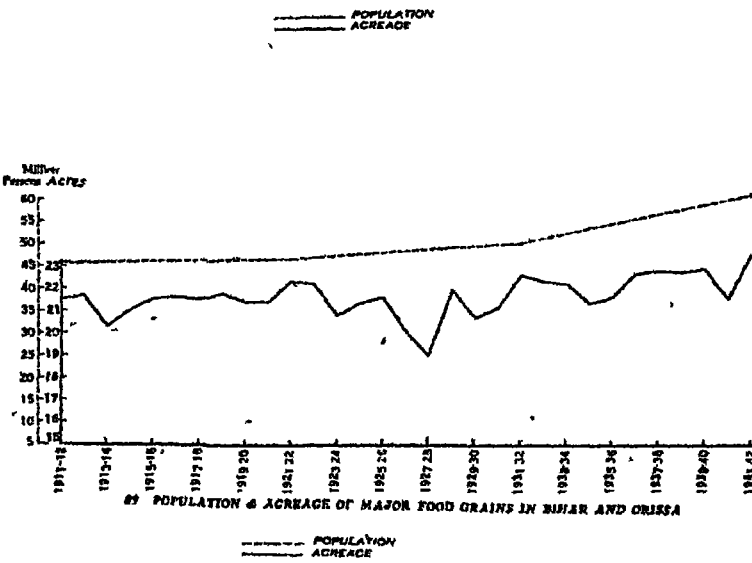
86 ACREAGE & PRODUCTION OF SUGARCANE IN THE UNITED PROVINCES



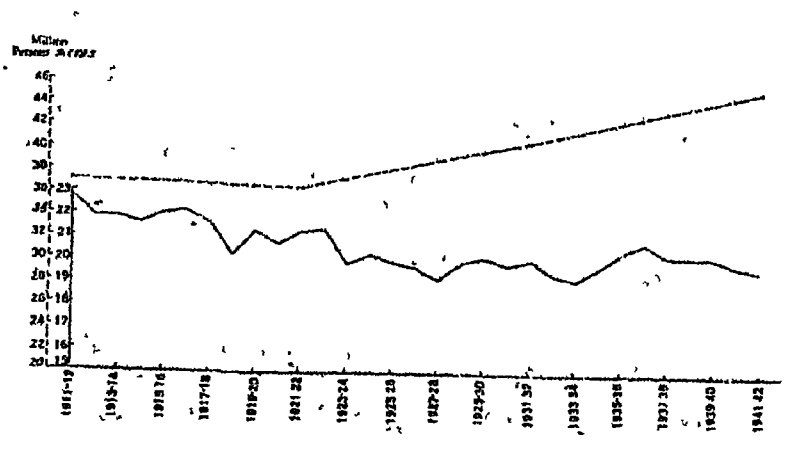
87 POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN ASSAM



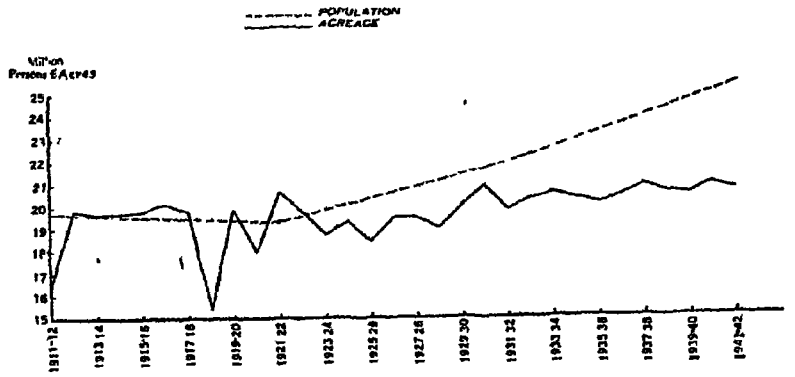
88 POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN BENGAL



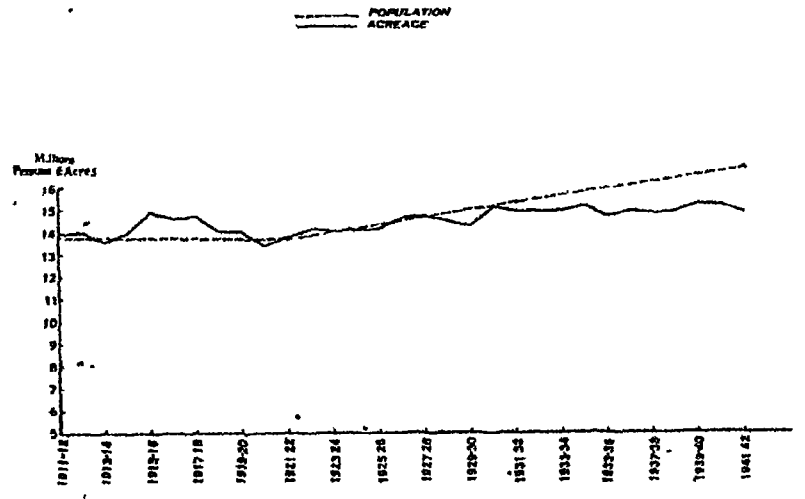
89 POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN BIHAR AND ORISSA



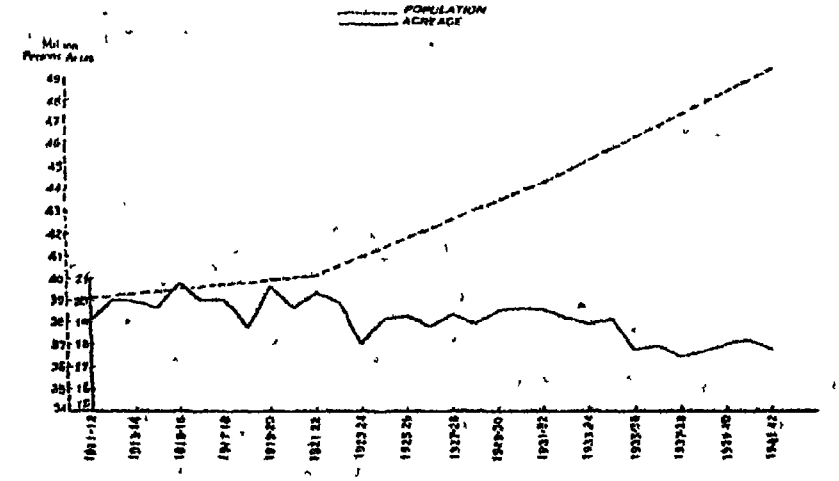
90. POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN BOMBAY INCLUDING SIND

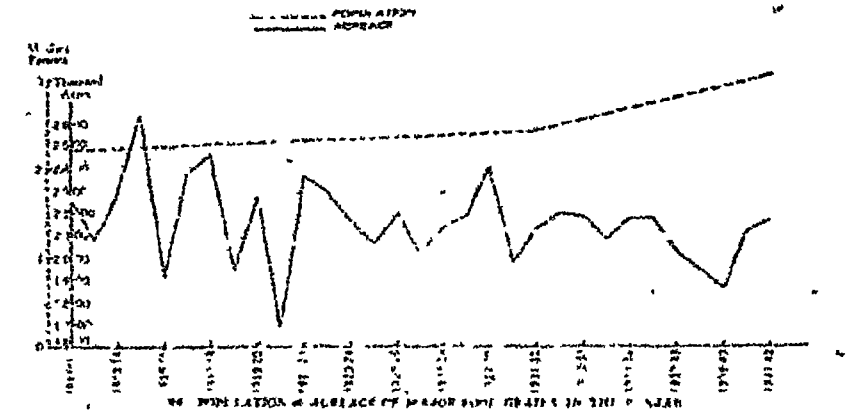


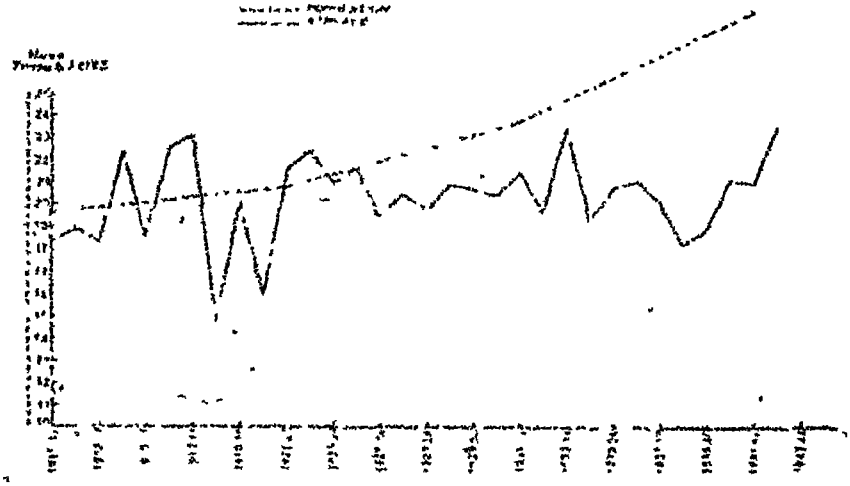
91 POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN THE CENTRAL PROVINCES AND BERAR

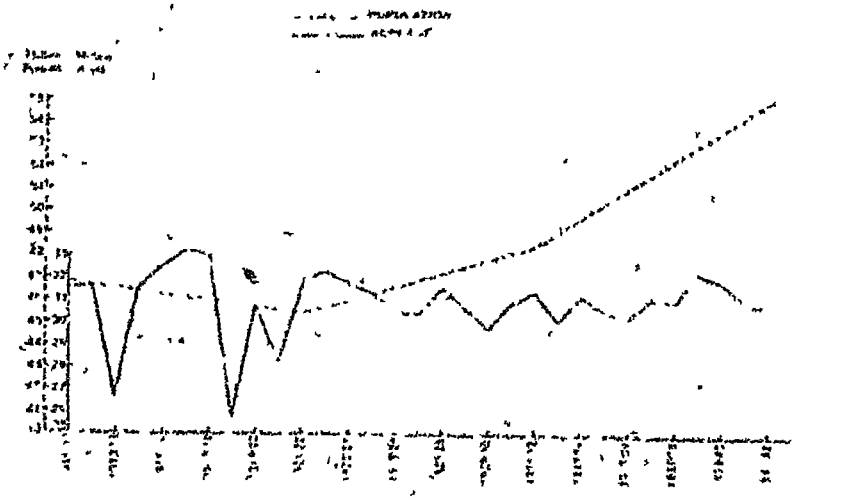


92 POPULATION & ACREAGE OF MAJOR FOOD GRAINS IN MADRAS



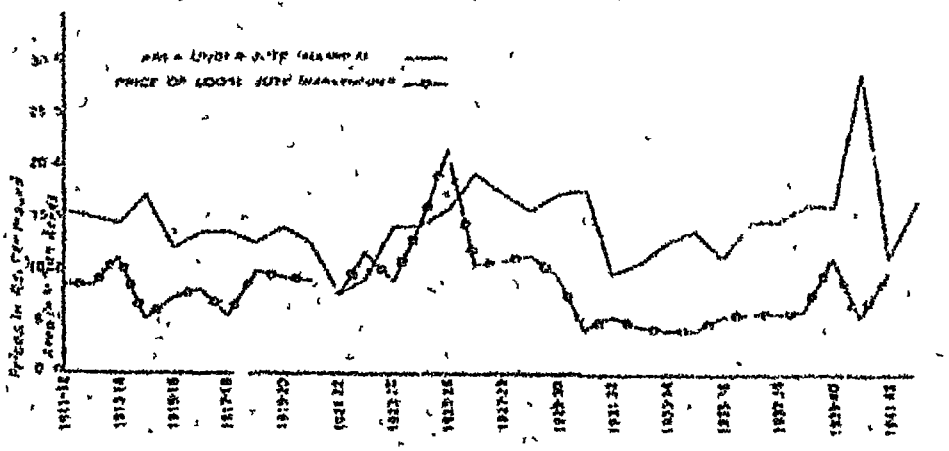






96 ACREAGE & PRODUCTION OF COTTON IN INDIA

97 JUTE ACREAGE & PRICES IN INDIA



2 ACREAGE & PRODUCTION OF WHEAT IN INDIA